FM 55-110

DEPARTMENT OF THE ARMY FIELD MANUAL

TRANSPORTATION PORT COMPANIES MILITARY STEVEDORING

DEPARTMENT OF THE ARMY • NOVEMBER 1952

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This manual supersedes TM 55-310, 20 May 1944, including C1, 16 May 1946

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United States Government Printing Office
Washington : 1952

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *5 November 1952*

FM 55–110 is published for the information and guidance of all concerned.

[AG 322 (22 Apr 52)]

BY ORDER OF THE SECRETARY OF THE ARMY:

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NG: Same as Active Army except two copies to each unit.
ORC: Same as Active Army except two copies to each unit.
For explanation of distribution formula, see SR 310–90–1.

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CHAPTER 1

INTRODUCTION

Section I. PURPOSE AND SCOPE

1. PURPOSE

This manual explains military stevedoring operations and procedures in port operations. It is intended to serve as a guide in the arts of stevedoring and the handling of military cargo as practiced in the Army; and as a guide to safe, orderly, and efficient procedures in port operations.

2. SCOPE

This manual covers the phases of military stevedoring in the general order in which they will be encountered. It deals with facilities, planning, stevedoring operations, safety factors, and maintenance. It discusses the proper procedures for loading, discharging, and stowing various types of cargo; equipment and expedients used for these operations; the care of this equipment; and the safety precautions necessary for the protection of the vessel, the cargo, and the personnel.

Section II. UNITS

3. TYPES OF UNITS

The port company is the basic stevedoring group assigned to a port. Port companies are designated as type A and type B. For further information, see paragraph 50.

4. MISSION

Type A and type B port companies provide personnel trained in discharging and loading cargo vessels at piers and offshore anchorages by means of ship's gear, cranes, and materials and cargo handling equipment. This includes all phases of stevedoring, such as winch operations, rigging, stowing, and checking.

5. CAPABILITIES

a. A type A port company is designed to handle a complete military operation, providing all labor from the company personnel. This company is considered capable of discharging an average vessel or its equivalent in a continuous operation (24 hours) at the rate of 720

short tons per day. It is capable of loading at the rate of 500 short tons per day.

b. A type B port company is designed to provide supervisory personnel for the operation of hatch gangs manned almost entirely by labor provided from other sources.

c. The tonnage capabilities furnished for the port companies are long-range planning factors based on an around-the-clock operation, 365 days a year. These capabilities include such delays to cargo operations as inclement weather, shifting of vessels, and idle days between vessels. The day-to-day tonnage figures will be far higher than the previously mentioned discharging and loading rates (*a* above) and will vary with the facilities available and type of cargo handled.

Section III. EQUIPMENT

6. ORGANIZATIONAL EQUIPMENT

As provided in T/O & E's 55–117 and 55–118, stevedore equipment is sufficient for the basic requirements of both types of port companies. This includes such items peculiar to cargo handling as land cranes, tractors and trailers, fork lift trucks, and cargo handling gear.

7. SPECIAL EQUIPMENT

Additional equipment as may be necessary for handling special cargo, such as floating cranes, barges, cargo trucks, etc., not available to the port company through a T/O & E, is normally available through other sources.

8. POOLING EQUIPMENT

Where several port companies or battalions are working on one port or in the same general vicinity, stevedore equipment usually is pooled under a consolidated motor or equipment pool to enable all companies to get a maximum utilization of such equipment, thereby increasing the over-all efficiency of all organizations.

Section IV. RESPONSIBILITIES OF MILITARY SEA TRANSPORTATION SERVICE (MSTS) AND TRANSPORTATION CORPS PERSONNEL

9. MSTS RESPONSIBILITIES AS VESSEL OPERATORS

The MSTS, under the control of the Navy, is responsible for control, operation, and administration of Government-owned vessels assigned, and all other vessels acquired, for the purpose of providing a carrier service for ocean transportation of personnel and material for the Armed Services. As vessel operators, the MSTS is responsible for providing vessels to transport cargo and personnel as required by the Army, the Air Force, and the Navy. Such vessels are manned, pro-

visioned, and ready to receive cargo. The responsibility of MSTS for cargo begins when the cargo is finally stowed on board and accepted by the master or commanding officer of the vessel, and terminates when the cargo is accepted free on board ship at destination.

10. RESPONSIBILITIES OF THE TRANSPORTATION CORPS AS THE SHIPPER SERVICE

The Transportation Corps, as the designated loading agency for the Army and the Air Force, is responsible for providing a berth for loading the vessels; for having cargo available for loading at the specified time; for preparing a loading plan; and for properly stevedoring the cargo. This responsibility includes the special preparation of a hold for receiving cargo, proper stowing, lashing, and shoring, as required, and the cleaning of the hold after the discharge of cargo.

Section V. RELATIONSHIP BETWEEN SHIP'S OFFICERS AND TRANSPORTATION CORPS PERSONNEL

11. GENERAL

Coordination and cooperation of Transportation Corps personnel with ship's officers is of the utmost importance in any stevedoring operation. Those in charge of stevedore operations aboard a ship should immediately become acquainted with the responsible ship's officers. Many seemingly unsurmountable problems encountered in cargo handling, stowage, or securing can be readily solved by following the advice of ship's officers based on their years of experience.

12. PREROGATIVES OF A SHIP'S MASTER

a. In every case, the master of a vessel is absolutely and completely responsible for the safe transportation of cargo. He is responsible for insuring that the stowage will not affect the safety or seaworthiness of his vessel.

b. Before loading, the stowage plan must have the approval of the master or his designated representative. Particular attention must be given to the proposed loading and stowage of any heavy lifts.

c. During time of emergency, certain safety rules may have to be overlooked and the vessel loaded over the protests of a ship's master. Such a protest, in writing and if valid, relieves the master of responsibility for the cargo stowage or vessel safety, depending upon the nature of the protest. Because of the importance placed on the master's protest in commercial life, when the master does make a protest in writing, and he is overridden by the responsible officer in charge, there should be no hard feelings nor action taken against him. Incidents of this kind are warranted only in cases of extreme emergency and, in any event, the vessel must always be in a seaworthy condition.

CHAPTER 2

PORT TERMINAL FACILITIES AND OPERATIONS

13. TERMINAL FACILITIES

a. Terminal facilities are those piers, wharves, warehouses, etc., available for the receipt, storage, loading, discharge, and dispatch of cargo, including the embarkation and debarkation of personnel.

b. Certain facilities common to longshoremen are defined as follows:

(1) A *wharf* is a structure built out into the water and parallel to shore.

(2) A *quay* is an improved, usually paved, area extending to the water's edge, faced with masonry or piling.

(3) A *pier* is a structure built out into the water, usually at right angles to the shore (fig. 1).

14. TERMINALS

a. The type of terminal to be developed is determined by the physical characteristics of the available water front. The two types in general use at the present time are pier and wharf terminals.

(1) The *pier-type* terminal, most commonly used in the United States, requires a small water front area but a wide harbor. Cargo movement on this type of terminal is restricted because there is only one entrance into the pier. This type of terminal generally is located on bays and open harbors or on wide rivers where water front area is limited. Examples of the pier type of terminal may be found in San Francisco and New York.

(2) The *wharf*-type terminal requires less width of water but more water front area. The wharf terminals in the United States are found mainly in river ports such as New Orleans or Portland, Oregon; however, this type of terminal, or the quay system which is similar in operation, is found mainly in European ports. It offers more advantages to cargo moving, because it has several possible entrances and exits.

b. Congestion involved in the loading or discharging of cargo is governed by the size of the terminal and the width of the apron rather than by the type of terminal.

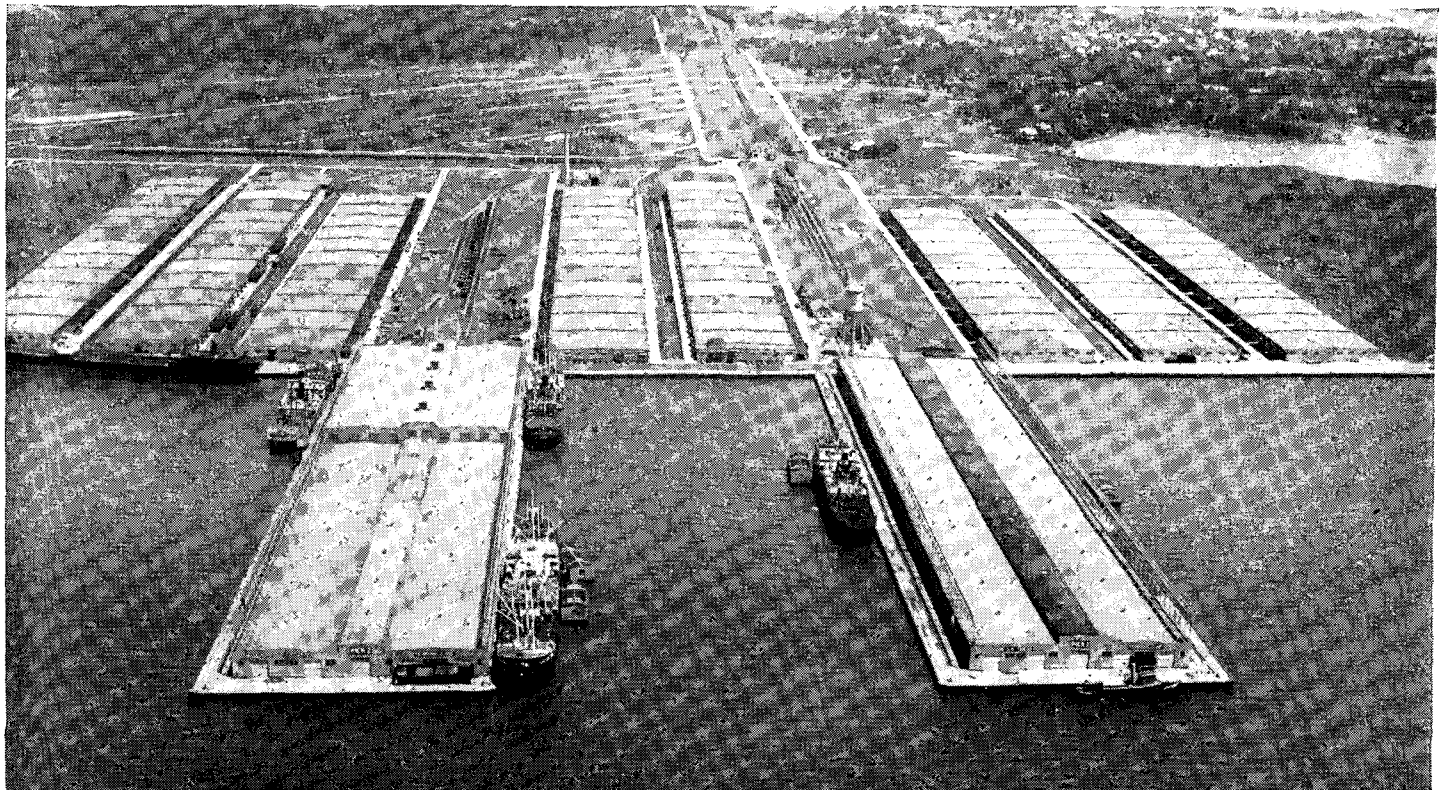
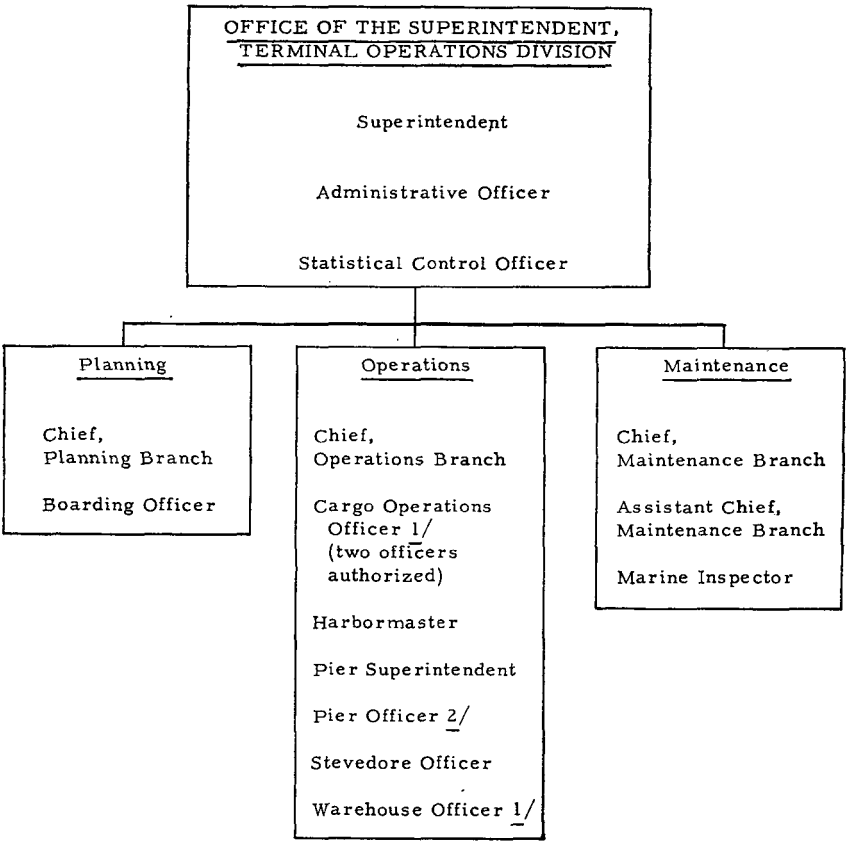


Figure 1. Typical pier.

15. ARMY PORT TERMINALS

A terminal operations division in an Army port is responsible for the discharge and loading of all water-borne cargo, including stevedoring, cargo checking, and movement to the initial mode of transportation or an in-transit warehouse; the operation of all harbor craft



1/ Authorized only for major ports.

2/ Two pier officers authorized for a major port.

Figure 2. Organizational chart, terminal operations division.

assigned to the port; and the berthing and unberthing of all vessels (fig. 2). Usually, this division has three branches. For detailed information on the terminal operations division, see FM 55–25.

a. Planning Branch. The planning branch is primarily responsible for furnishing necessary operating information.

b. Operations Branch. The operations branch is responsible for the operating activity of the division.

c. Maintenance Branch. The maintenance branch is responsible for the maintenance and repair of marine equipment and harbor craft.

16. OPERATIONS

a. In the continental United States, the terminal operations personnel will have modern terminals and equipment to perform their mission.

b. In theaters of operation, the operations may be conducted over modern piers and wharves; but usually they will be conducted over beaches with little or no facilities or in damaged ports where bombing or demolition has rendered the facilities almost useless.

c. Personnel assigned to or working in conjunction with the discharge of vessels overseas must be able to improvise in order to efficiently complete each assignment.

CHAPTER 3

PRESTOWAGE PLANNING

Section I. VESSEL DATA

17. GENERAL

Before attempting to load cargo aboard vessels, the following information must be known and understood:

a. Types of vessels.
b. Vessel tonnages.
c. Limiting physical characteristics.
d. Planning factors.
e. Terms and definitions.

18. TYPES OF VESSELS

a. Vessels are designed for a particular purpose. Some are designed to carry cargo, others for passengers or troops, and some for both cargo and troops. Differences in hold construction, cargo handling and other equipment, cargo ballasting arrangements, and location of engines all have a bearing upon the type of cargo a ship is best fitted to carry.

b. Vessels may be classified according to the types of service each is capable of performing.

(1) *Passenger.* These vessels are designed primarily for the transporting of passengers, mail, express, and high priority freight. They have comparatively small cargo space. Loading and discharging of cargo on this type of vessel are generally difficult because of the small hatch openings.

(2) *Combination passenger and freight.* This class of vessel has a larger cargo space than the passenger liner and, in addition to carrying a large number of passengers, carries general cargo of almost every description. It includes vessels of many types, speeds, and sizes, depending upon the particular trade for which the vessel is built. Careful prestowage planning for loading, discharging, and stowage is necessary because of the number of ports of call scheduled for these vessels.

(3) *Cargo.* Cargo vessels are designed to carry cargo exclusively, but in most cases have accommodations for a few passengers. These vessels are designed to carry all types of cargo. They are fitted with special heavy-lift cargo booms capable of handling weights up to 30 or 50 tons. Army longshoremen will come in contact with this type of vessel most often (figs. 3–7).

(4) *Special purpose.* This class of vessel is designed for carrying a specific type of cargo and is not suitable for other purposes.

(*a*) *Tankers.* Tankers are designed for transporting bulk petroleum products. All propulsion machinery, etc., is in

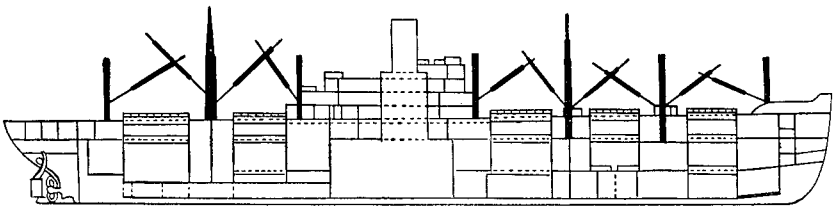


Figure 3. C–3 type vessel.

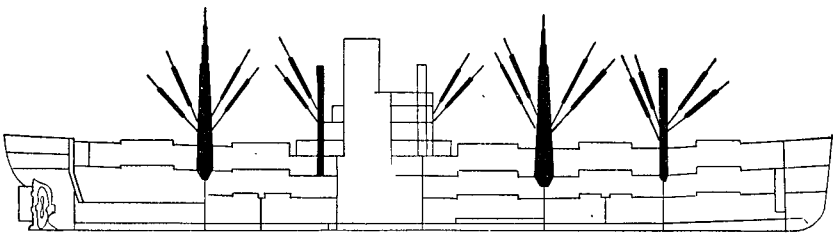


Figure 4. C–2 Type vessel.

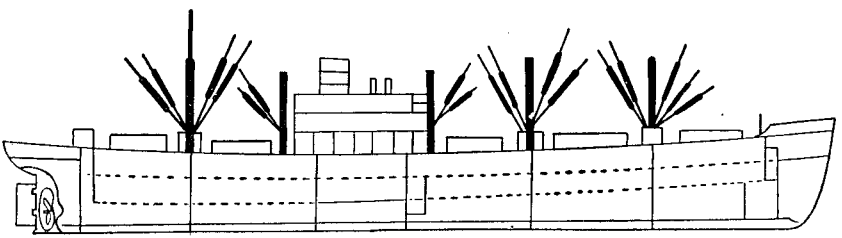


Figure 5. C–1 type vessel.

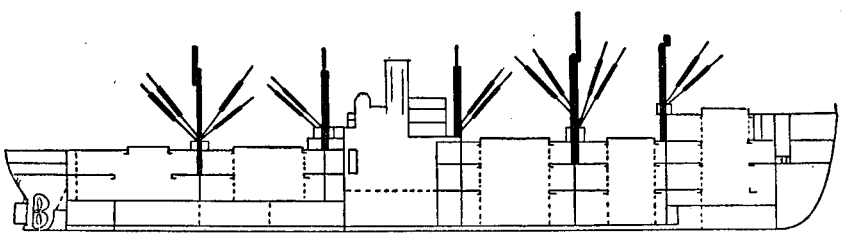


Figure 6. VC–2 (Victory) type vessel.

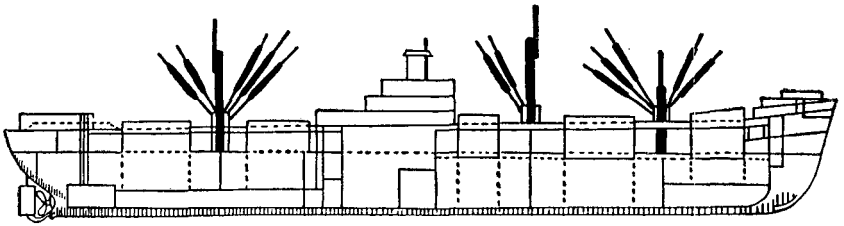


Figure 7. EC-2 (Liberty) type vessel.

the stern of the vessels to allow uninterrupted space for tanks. They are equipped with pumps and other such equipment to permit them to be self-discharging.

(*b*) *Colliers.* This type of vessel was designed to carry bulk ore or coal. Most are of the same general design as tankers to permit a large cargo space uninterrupted by the propulsion machinery or the shaft tunnel. Hatches on colliers are made as large as possible to permit expeditious loading and discharge, usually by mechanical means.

(*c*) *Seatrains.* Seatrain vessels are oceangoing steamers approximately 400 feet in length and capable of carrying 100 loaded freight cars. In time of war these vessels are very useful in the transport of vehicles, locomotives, railroad cars, and tanks because of their speed and the ease with which they may be loaded and discharged (fig. 16).

19. VESSEL TONNAGES

Whatever the intent of the design of a vessel, each vessel has definite standards by which it is classified.

a. Tons.

(1) *Volume or space tons.* A measurement (ship) ton is a measurement of the space occupied by cargo. The unit of measurement is 40 cubic feet. Multiply height by length by width and divide result by 40 to determine the number of measurement tons.

(2) *Weight tons.*

(*a*) *Long ton.* A measurement of weight in units of 2,240 pounds is a long ton.

(*b*) *Short ton.* A measurement of weight in units of 2,000 pounds is a short ton.

(*c*) *Metric ton.* A measurement of weight equal to 1,000 kilograms or 2,204.6 pounds is a metric ton. This weight measurement is used in countries in which the metric system is used.

b. Tonnages.

(1) *Volume or space tonnage.*

(*a*) Gross tonnage is the entire cubic capacity of a vessel expressed in tons of 100 cubic feet each, excluding the space occupied by the peak and other tanks used for water ballast, open forecastle bridge and poop, certain light and air spaces, and domes of skylights, etc.

(*b*) Net tonnage, also referred to as net registered tonnage, is obtained by *deducting* from the gross tonnage certain allowances for crew and navigating spaces and propulsion machinery space. Net tonnage represents the earning space of the ship and is used by maritime nations as a basis for port and navigation charges.

(2) *Displacement tonnage* (weight tonnage).

(*a*) Displacement loaded is the weight of the entire ship, including the vessel itself, fuel, water, stores, dunnage, crew, and cargo.

(*b*) Displacement light is the weight of the vessel less cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on the voyage. The term "light ship tonnage" is the same as the term "displacement light."

(3) *Deadweight tonnage.* The total carrying capacity of a vessel or the difference between displacement light and displacement loaded is known as deadweight tonnage. It includes the weight of fuel, water, stores, dunnage, crew, and cargo. It varies on any particular vessel according to the seasonal zones through which the vessel will proceed. For further information, refer to the discussion of load lines in paragraph 20*k*.

(4) *Cargo deadweight tonnage.* The actual pay load of the vessel is known as cargo deadweight tonnage. It is obtained by deducting the weight of fuel, water, stores, and dunnage from the deadweight tonnage.

(5) *Bale cubic capacity.* The space available for loading cargo measured in cubic feet to the inside of the cargo battens, on the frames, and to the under side of the beams is known as bale cubic capacity. This measurement is used to compute the space available for general cargo.

(6) *Grain cubic capacity.* The maximum space available for cargo measured in cubic feet to the inside of the shell plating and to the under side of the deck plating of a ship is known as grain cubic capacity. This measurement is used for computing cubic space available for loading bulk commodities such as grain, etc.

20. VESSEL DESIGNATIONS

In addition to the vessel tonnages listed previously, there are certain terms pertaining to a vessel which must be understood.

a. Draft and Draft Marks. Draft marks are 6-inch numerals painted on the bow and stern of a vessel to indicate the depth to which the bow and stern are submerged. The base of the numerals mark the even foot marks.

b. Mean Draft. The average of the forward and aft drafts is the mean draft.

c. Freeboard. The distance from the water to the edge of the main deck line measured amidships is freeboard.

d. Trim. The longitudinal position of a vessel in the water is the trim.

e. Down by the Head. A vessel is in this condition when the bow draft is lower than the stern draft.

f. Drag. The number of feet that the stern is lower than the bow is the drag.

g. Tender Ship. A vessel with excessive weight in the 'tween decks and insufficient weight in the lower hold is a tender ship. It has a long, slow roll and a tendency to capsize.

h. Stiff Ship. Just the opposite from a tender ship, a stiff ship has a tendency to "snap back" from a roll in a sudden jarring manner.

i. Sagging. Sagging is caused by excessive weight in the midship section of a vessel and insufficient weight in the bow or stern.

j. Hogging. The reverse of sagging, hogging is caused by excessive weight in the bow and stern and not enough weight amidships. Both hogging and sagging place a severe strain on the vessel.

k. Load Line or Plimsoll Mark. The load line or plimsoll mark is placed amidships on the hull of a vessel to denote the maximum draft to which a vessel may be loaded for a particular voyage, depending upon the area to be traveled and the season of the year. In figure 8 the circle intersected by the line AB indicates the summer load line.

21. PLANNING FACTORS

The planning of the loading of a vessel involves the use of certain factors to insure the most economical use of the available space.

a. Cargo Stowage Factor. The figure which denotes the number of cubic feet required to stow 1 long ton of a specific item of cargo is known as the cargo stowage factor. This factor is obtained by dividing the cubic measurement (in feet) of an item by its weight (in long tons).

b. Vessel Stowage Factor. The figure which indicates the relationship between the cargo deadweight tonnage and the space available

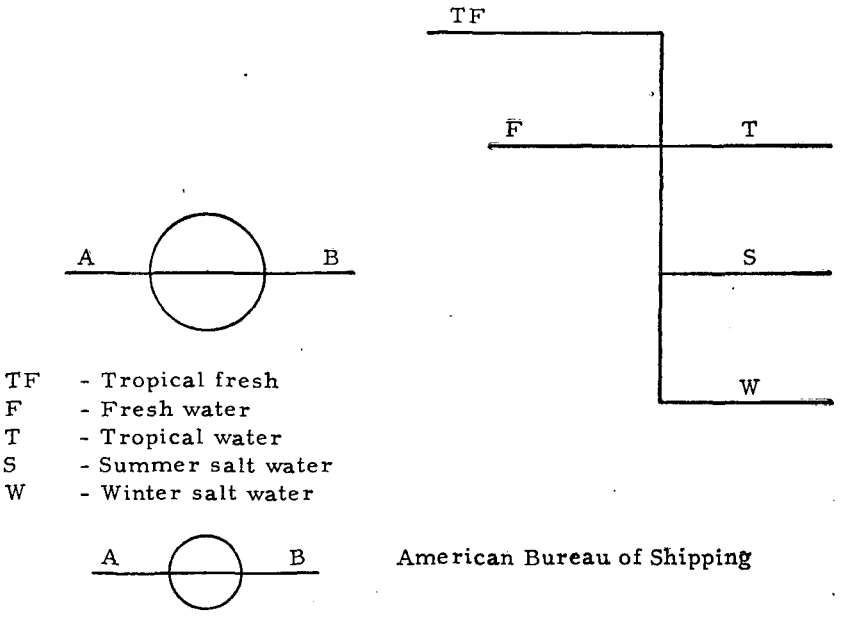


Figure 8. Load line or plimsoll mark.

for stowage of cargo is known as the vessel stowage factor (VSF). The VSF is obtained by dividing the cubic space available for loading cargo by the number of long tons to be loaded, exclusive of deck cargo. The stowage factor of any particular hold can be obtained in the same manner.

c. Broken Stowage. The space lost in the hold because of the contour of the ship and the shape of the cargo containers is called broken stowage. A typical well balanced general cargo will have from 10 to 15 percent broken stowage, and a complete load of vehicles will utilize only 60 to 70 percent of the available cubic space (fig. 9).

d. Free Space. The unused space in the holds of a vessel caused by the low stowage factor of the cargo or insufficient cargo to fill the space available is known as free space (fig. 10).

e. Full and Down. This term means that all available cubic capacity has been utilized (full), and sufficient weight is aboard to submerge the vessel to her legal load line (down); therefore, all the weight lifting capacity, as well as the cubic capacity of the vessel, has been utilized for a particular voyage. In a full condition below deck, allowance must be made for broken stowage.

22. PHYSICAL CHARACTERISTICS

a. In addition to the size of the cargo compartments, the physical structure of the vessel presents certain limiting characteristics which must be considered before loading cargo:

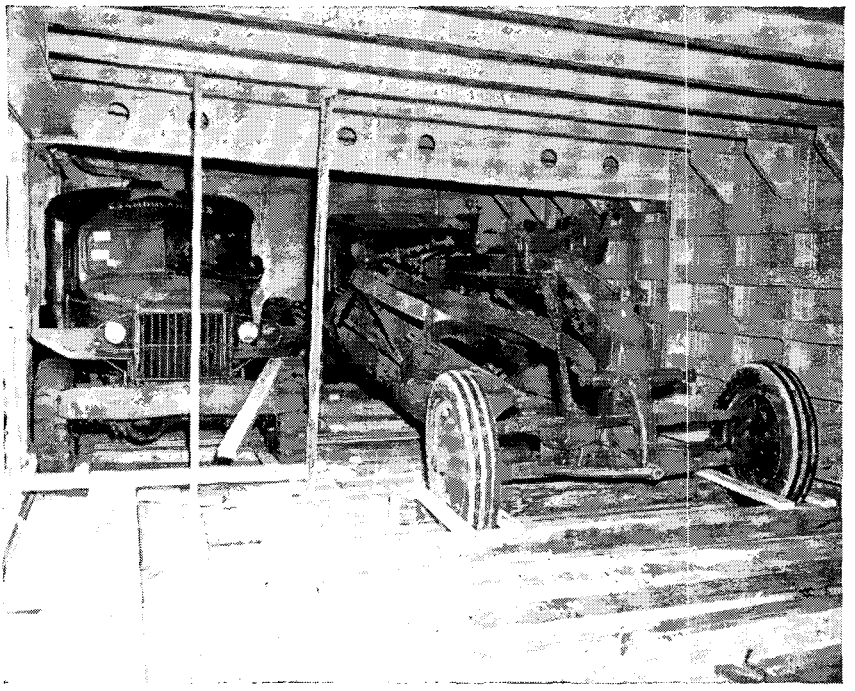


Figure 9. Cargo space lost because of shape of items stowed.

(1) Size of the hatch opening.
(2) Headroom under deck.
(3) Weight per square foot allowable.
(4) Capacity of the cargo booms.

b. In addition to the limitations mentioned previously (*a* above), allowance for certain other obstructions must be made before the preplanning is complete. Those which reduce the cubic space available for cargo stowage are stanchions, ladders, escape hatches, center line bulkheads, overhead beams, and tank tops. Personal inspection of a hatch before loading will disclose whether any or all of these obstructions are present.

23. VESSEL CAPACITY

Preparing a loading plan is more involved than merely allocating cargo to the different holds. The cargo deadweight tonnage must be so arranged that the vessel will be correctly trimmed and in a stable condition:

a. The Vessel Deadweight Scale (fig. 11). The vessel deadweight scale is designed to furnish vessel tonnages and the effects of these tonnages on the mean draft of the vessel.

(1) The left column of the deadweight scale represents the number of long tons that may be carried in the vessel,

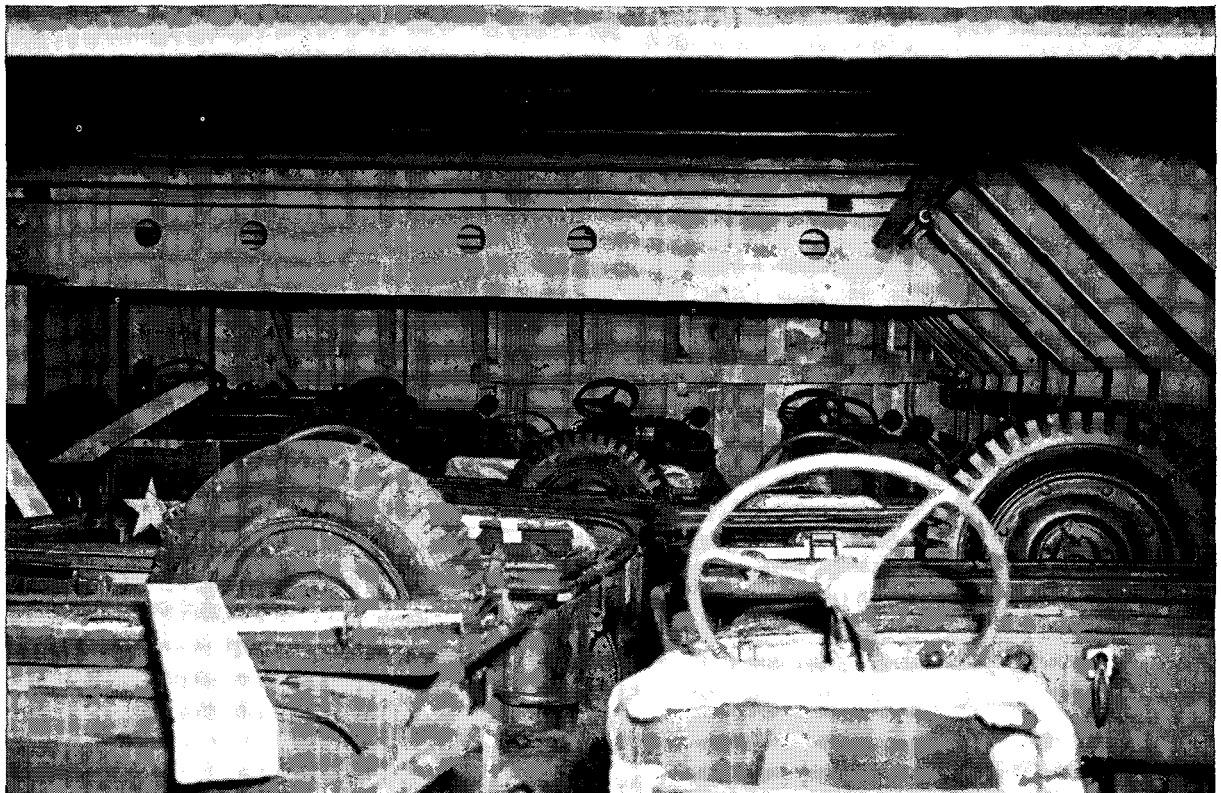


Figure 10. Vehicles stowed in 'tween deck showing free space between vehicles and deck.

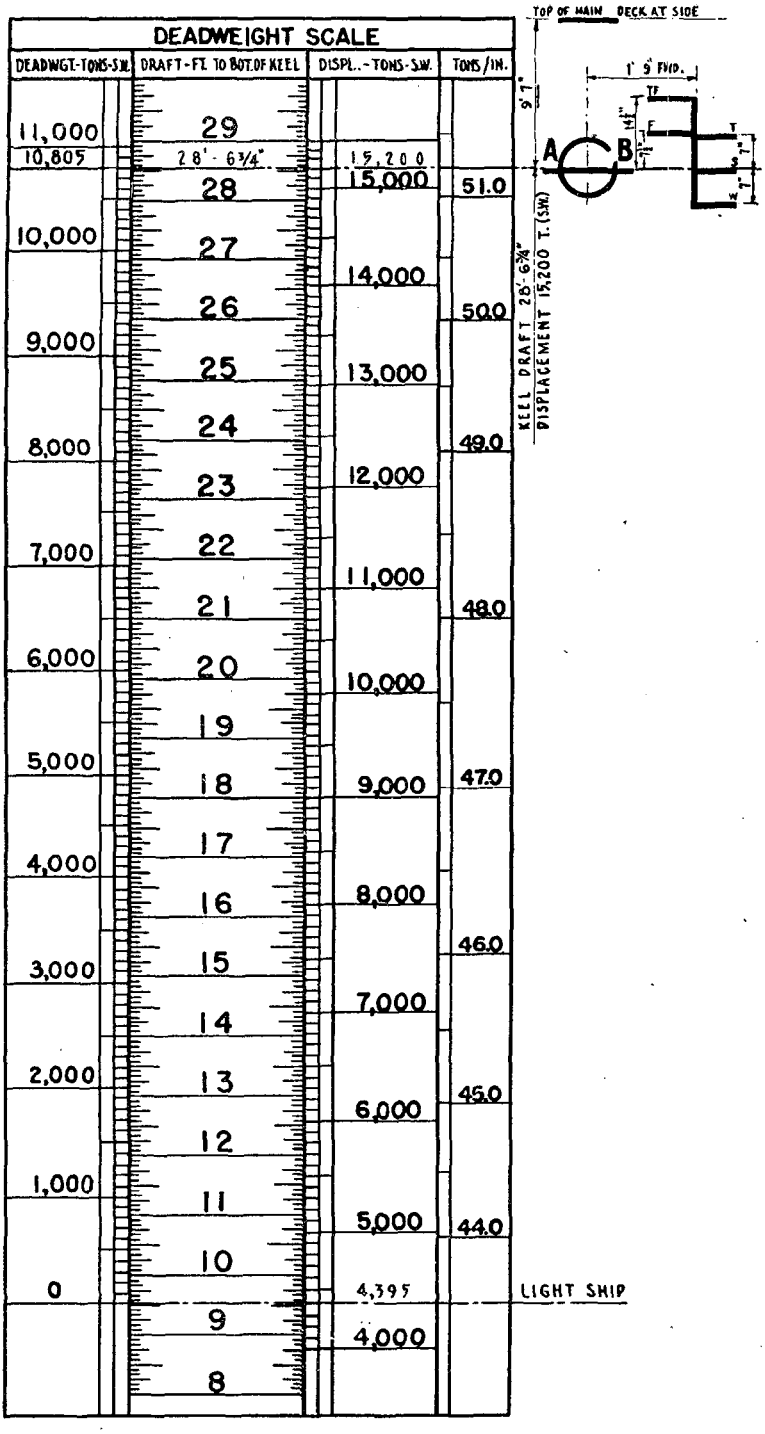


Figure 11. Deadweight scale for Victory-type vessel.

including fuel, stores, water, dunnage, and cargo, or any material that may be placed in the vessel, excluding equipment and machinery necessary for the operation of the vessel.

(2) The column headed DRAFT represents the vessel's mean draft in feet and inches. This scale is graduated from the least possible draft of 8 feet to a maximum draft of 29 feet.

(3) The column headed DISPL. TONS SW (displacement, tonnage in salt water) represents the weight of the ship plus any material placed in or on the vessel.

(4) The column at the right headed TONS/IN (tons per inch immersion) denotes the number of long tons required to sink the vessel down 1 inch with any given draft.

b. Use of the Deadweight Scale. The deadweight scale is used by the cargo planner to determine the long tons that may be placed in a vessel to reach the required draft. For example, a vessel loaded with 9,000 long tons will have a mean draft of 25 feet 4½ inches at the beginning of the voyage and, using 50 long tons of fuel, stores, and water per day at sea, will have used 500 long tons through a period of 10 days, thus reducing the mean draft to 24 feet 6 inches. From these figures the cargo planner can determine the vessel draft at the completion of the trip, and he will know whether the draft is correct for the type of harbor where the cargo will be discharged.

c. Cargo Deadweight Tonnage.

(1) In the deadweight column shown on the deadweight scale (fig. 11), the figure 0 is listed directly opposite the light ship weight. The figures above 0 indicate weight added to the vessel in the form of fuel, stores, and cargo. All weight placed in the vessel will increase the ship's mean draft and, by adding 10,805 long tons to the light ship, the vessel will be forced down in the water to a maximum mean draft of 28 feet 6¾ inches for sailing in summer salt water.

(2) Certain complications may be involved in determining the cargo deadweight tonnage of the vessel. For instance, the ship may have a fixed ballast that is not entered in the deadweight scale. In such an event, the ship's officers will add this to the number of tons of fuel, stores, and water that are on board. Also, they will note the location of the ballast in the ship. This must be deducted from the deadweight tonnage, together with the fuel, stores, and water, to give a correct cargo deadweight tonnage (par. 19*b* (4)). When the vessel is at a mean draft of 28 feet 6¾ inches, summer salt water, it is in a condition known as displacement loaded, and, should weight in excess of 10,805 long tons be loaded in a light ship, it would be forced down in the water below the legal load line for summer zone and would not be allowed to sail (fig. 11).

d. Prevention of Overloading.

(1) To prevent overloading the vessel, the weight of the fuel, stores, and water should be determined and deducted from the deadweight scale to obtain the draft of the vessel at this deadweight tonnage. For example, let us consider that the vessel to be loaded will have the following aboard:

	Long tons
Stores	340
Fuel oil	1,700
Fresh water	240
Dunnage	100
Total	2,380

Thus, the total tonnage in fuel, water, and stores on board the vessel when sailing will be 2,380 long tons. Since this weight will be in the vessel, it must be deducted from the vessel's deadweight tonnage to determine the number of tons of cargo that can be carried in the ship. From the deadweight scale it is determined that the maximum deadweight tonnage for this voyage is 10,805 long tons. Therefore, 2,380 long tons of fuel, stores, and water on board must be deducted from the deadweight tonnage to obtain the cargo deadweight tonnage. The maximum deadweight tonnage (10,805) minus the total tonnage (2.380) equals 8,425 long tons, the weight which may be loaded aboard the vessel.

(2) In many instances, it will not be possible to load the vessel to its maximum deadweight tonnage because of the high stowage factor of the cargo. In this event the cargo planner will utilize as much of the cargo deadweight tonnage as possible.

24. WEIGHT DISTRIBUTION

a. When the vessel's cargo deadweight tonnage has been obtained, it is prorated throughout the vessel's cargo compartments. This tonnage must be distributed so that no undue strain will be placed on the vessel.

b. The most efficient method for obtaining this ratio is through the application of the VSF. To determine this factor, the planner must know how many cubic feet of space are available for stowing cargo in the vessel (fig. 12). He must, then, take the following steps:

(1) Deduct the weight of any deck cargo from the cargo deadweight tonnage to determine the number of long tons that will be stowed under deck.

(2) Divide the cubic space for loading cargo by the number of long tons to be loaded.

SHIP'S STORES				
SPACE	DECK	FR^{S}	SIDE	BALE CU FT
PAINT LOCKER	FOCSL DECK	36-38	PORT	154
LAMP LOCKER	" "	36-38	STBD	141
BOS'N STORES	MAIN DECK	8-14	℄	2,301
BOS'N STORES IN WAY OF MAST	" "	51-53	P & S	325
" " " " " "	" "	121-123	P & S	325
" "	SECOND DECK	A-11	℄	2,080
DRY STORES	" "	82-89	PORT	2,972
STWDS STORES	" "	91-95	PORT	1,314
ROPE LOCKER	AFT FLAT 35'-6"	158-163	STBD	870
ENG'RS STORES	MACH'Y FLAT	90-93	PORT	1,080
STOREROOM	AFT FLAT 35'-6"	147-155	STBD	1,885
STOREROOM	" " " "	147-152	PORT	325
TOTAL SHIP'S STORES				13,772
REFRIGERATED SHIP'S STORES				
VEGETABLE BOX	SECOND DECK	78-84	STBD	2,004
HANDLING ROOM	" "	84-89	"	604
FISH BOX	" "	84-86	"	269
DAIRY BOX	" "	86-89	"	371
MEAT BOX	" "	89-95	"	1,347
TOTAL SHIP'S REFRIGERATED STORES				4,595

LUBRICATING AND DIESEL OIL							
NO.	TANK	FR^{S}	C OF G		OIL 98% FULL		
			FROM ℄	ABV B L	GALLONS	BARRELS	TONS
	LUB OIL STORAGE S	94-95	-36.52	31.28	1777	42	6.4
	" " SETTING P	94-95	-36.52	31.28	1772	42	6.4
	DIESEL OIL P	90-95	-31.50	2.00	815	19.5	2.6
	" " S	90-95	-31.50	2.00	815	19.5	2.6
	D O FOR DIES'L GEN	101	-57.10	51.86	90	2.0	0.3
	F O FOR GALLEY RANGE	101-102	-57.60	48.46	27	0.5	0.1
	FRESH WATER						
NO.	TANK	FR^{S}	C OF G		F W 100% FULL		
			FROM ℄	ABV B L	GALLONS	BARRELS	TONS
	DISTILLED WATER S	74-78	+18.02	17.29	5,710		21.2
4A	RES FEED DBL BOT P	79-89	- 5.65	2.01	14,850		55.1
4A	" " " " C	79-89	- 6.00	2.00	17,704		65.7
4A	" " " " S	79-89	- 5.99	2.02	15,407		57.2
	POTABLE WATER C	95-99	-45.00	21.52	25,783		95.7
	TOTAL FRESH WATER				79,454		294.9

Figure 12. Capacities for Victory-type vessel.

DRY CARGO					
SPACE	FRS	C OF G		CUBIC FEET	
		FROM ℄	ABV B L	GRAIN	BALE
NO. 1 FOCSL 'TWEEN DECK	14-37	161.2	44.8	25,510	22,045
UPPER 'TWEEN DECK	14-37	159.8	33.8	28,100	23,785
HOLD	14-37	158.0	18.9	32,690	27,910
TOTAL HOLD NO. 1				86,300	73,740
NO. 2 UPPER 'TWEEN DECK	37-52	+112.6	33.5	30,310	27,010
LOWER 'TWEEN DECK	37-52	+111.5	22.6	25,965	21,805
HOLD	37-52	+110.7	10.9	33,095	27,945
TOTAL HOLD NO. 2				89,370	76,760
NO. 3 UPPER 'TWEEN DECK	52-78	+51.2	33.1	50,905	45,555
LOWER 'TWEEN DECK	52-78	+53.0	22.5	44,755	37,795
HOLD	52-78	+52.9	10.7	62,340	52,840
TOTAL HOLD NO. 3				158,000	136,190
NO. 4 UPPER 'TWEEN DECK	95-122	-80.9	.33.3	54,405	49,200
HOLD	95-122	-80.9	21.1	58,675	51,100
TOTAL HOLD NO. 4				113,080	100,300
NO. 5 UPPER 'TWEEN DECK	122-147	-156.0	34.8	49,190	43,630
HOLD	122-147	-149.0	21.4	32,385	25,905
TOTAL HOLD NO. 5				81,575	69,535
GRAND TOTAL DRY CARGO				528,325	456,525

FUEL OIL AND WATER BALLAST								
NO.	TANK	FRS	C OF G		FUEL OIL 98% FULL			S W BALLAST
			FROM ℄	ABV B L	GAL	BARRELS	TONS	TONS-100%FULL
1	DBL BOT P	14-37	+156.97	5.77	36,210	862.0	130.0	141.1
1	" " S	14-37	+156.97	5.77	36,210	862.0	130.0	141.1
2	" " P	37-52	+106.73	2.13	10,360	246.5	37.2	40.4
2	" " C	37-52	+111.99	2.01	25,215	600.5	90.5	98.3
2	" " S	37-52	+106.73	2.13	10,360	246.5	37.2	40.4
3	" " P	52-78	+ 49.81	2.02	37,518	893.5	134.7	146.2
3	" " C	52-78	+ 51.00	2.00	44,781	1066.0	160.8	174.5
3	" " S	52-78	+ 49.81	2.02	37,518	893.5	134.7	146.2
4B	" " P	90-95	- 31.44	2.02	7,288	173.5	26.2	28.4
4B	" " S	90-95	- 31.44	2.02	7,288	173.5	26.2	28.4
5	" " P	95-122	- 68.42	2.14	22,617	538.5	81.2	88.1
5	" " C	95-122	- 79.10	2.02	46,201	1100.0	165.9	180.1
5	" " S	95-122	- 68.42	2.14	22,617	538.5	81.2	88.1
	TOTAL DOUBLE BOTTOM TANKS				344,183	8194.5	1235.8	1341.3

Figure 12. Capacities for Victory-type vessel—Continued.

NO.	TANK		FRS	C OF G FROM	C OF G ABV B L	FUEL OIL 98% FULL GAL	FUEL OIL 98% FULL BARRELS	FUEL OIL 98% FULL TONS	S W BALLAST 100% FULL
4A	DEEP	P	95-110	-61.42	9.40	98,718	2350.5	354.5	384.8
4A	"	S	95-110	-61.16	9.42	83,087	2121.6	319.9	347.2
4B	"	P	110-122	-101.06	9.61	66,231	1577.0	237.8	258.1
4B	"	S	110-122	-100.94	9.63	59,102	1407.0	212.2	230.3
5	"	P	122-139	-140.80	8.57	59,956	1427.5	215.3	233.7
5	"	S	122-139	-139.84	8.38	49,807	1186.0	178.9	194.1
	TOTAL DEEP TANKS					422,901	10,069.0	1518.6	1648.2
	FOREPEAK		14-FWD	+201 27	18.30				106.0
	AFT PEAK		147AFT	-200 27	22.77				34.0
	TOTAL PEAK TANKS								140.0
	F O SETTLING P		74-78	+18.02	16.02	17,794	423.5	63.9	
	F O SETTLING S		74-78	+18.02	16.02	17,917	426.5	64.3	
	TOTAL SETTLING TANKS					35,711	850.0	128.2	
	GRAND TOTAL-F O & WAT BALLAST					802,795	19,113.5	2,882.6	3,129.5

Figure 12. Capacities for Victory-type vessel—Continued.

c. It is then possible to divide the cubic capacity of each cargo compartment by the VSF to determine the number of tons to be allocated to each compartment. This method of correlating tonnage and space will insure equal weight distribution throughout the entire vessel and will prevent placing a strain on any longitudinal part of the vessel.

d. For example, if a vessel has a bale cubic capacity of 456,525 cubic feet and a cargo carrying capacity of 8,425 long tons, the VSF would be 54.2 for full and down. The cubic capacity of each cargo compartment is then divided by the VSF (54.2) to obtain the amount of weight to be allocated to each. If, however, the cargo available for loading has such a high stowage factor that the weight lifting capacity of the vessel is not utilized or is not sufficient to completely fill the vessel, the bale cubic capacity of the vessel (456,525 cubic feet) is divided by the weight of the cargo available for loading (7,430 long tons) to obtain the VSF which, in this case, is 61.4. The cubic capacity of each cargo compartment is then divided by the VSF to determine the distribution of the weight.

e. It should be noted that when VSF is used to prorate the tonnage for each compartment, the cargo deadweight tonnage does not always

agree with the figure previously used. This discrepancy is the result of using round numbers to the nearest tenth and may be corrected by deducting from or adding to one of the compartment tonnages. Experience will show that round numbers will suffice even though discrepancies will result.

25. STABILITY

a. Stability is defined as the measure of inherent ability of the ship to right itself when rolled or heeled by heavy seas or wind.

b. The center of gravity of the weight in the vessel determines its measure of stability.

(1) If the center of gravity is too high because of heavy cargo in the 'tween decks and lighter cargo in the hold, the vessel has a tendency to become "tender" and may develop a list or, in extreme cases, may capsize.

(2) If the center of gravity is too low because of excessive weight in the lower holds, the vessel will become "stiff".

c. Prorating the weight of the cargo to be loaded by using the VSF, as explained in paragraph 24, will distribute the weight throughout the vessel, thus maintaining the proper stability.

d. The rule of thumb for distributing cargo is usually two-thirds of the cargo by weight in the lower holds, and one-third between the decks and on deck. The weight of the deck cargo must not exceed 10 percent of the total weight of the cargo to be loaded.

26. TRIM

a. Trim is the term used to describe the position of the ship in relation to the still water level when viewed from broadside. It is a very important factor in the way a ship handles for a voyage and is of particular concern to the master. The trim of a vessel is largely determined by the stowage of cargo. Improper stowage will result in the vessel's being down by the stern or down by the head. Most masters prefer the stern to be from 2 to 4 feet lower in the water than the bow.

b. Distribution of the cargo weight throughout the vessel by use of the VSF, as explained in paragraph 24, will provide a normal trim for the vessel. In the event the master prefers a drag different from that developed through the distribution of weight by the VSF, the trimming scale or table must be used.

c. The trimming scale or table (fig. 13) indicates how each portion of the vessel will be affected in terms of the number of inches of immersion by 100 long tons loaded at any point along the keel. This scale also indicates the number of inches one end of the vessel will rise in the water when 100 long tons are loaded in the opposite end.

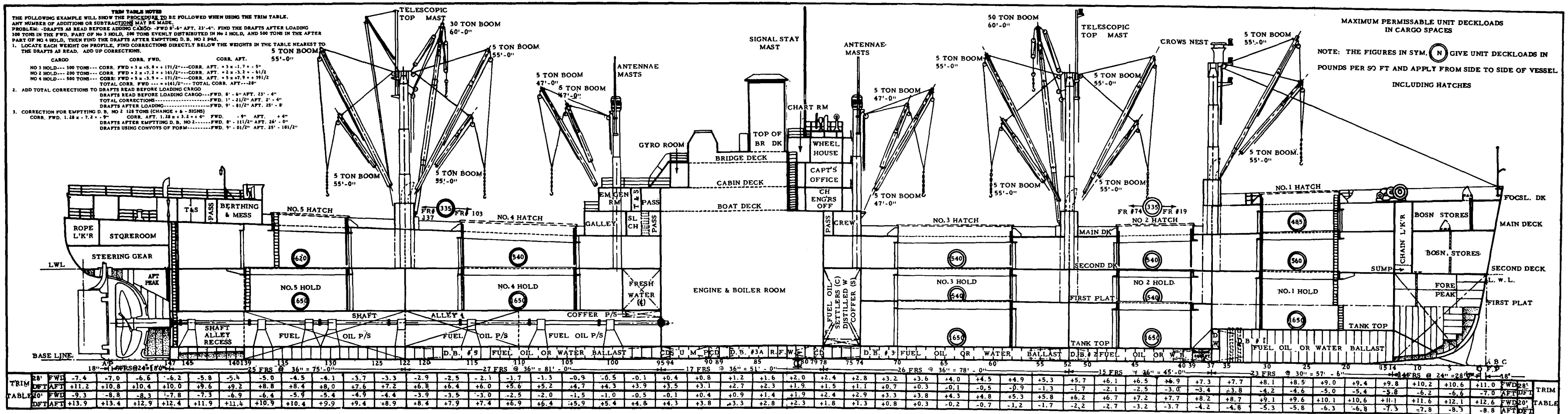


Figure 13. *Trim table for a Victory-type vessel.*

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d. The trim table (fig. 13) is applied as follows:

(1) Assume that 200 long tons are to be loaded in No. 2 hold and that the weight will be distributed evenly throughout the hold.

(*a*) Using the correction figures directly under the center of the hold on the 20-foot scale, it is seen that the bow draft will increase 7.2 inches and the stern draft will decrease 3.2 inches for each 100 long tons loaded. By multiplying the corrections by 2 (200 tons to be loaded), it is determined that the bow will sink 14.4 inches in the water and the stern will rise 6.4 inches out of the water.

(*b*) Another method of applying the trim table is to take the average correction between the bulkheads of the hold for each of the forward and aft corrections to obtain the change in draft.

(2) Assume that the 200 tons is placed in a particular position in the hold. By using the correction figure directly under the place of stowage, the change in draft may be determined in the same manner as in (1) (*a*) above.

e. In order to maintain the proper trim during loading, it is necessary to periodically check the fore and aft drafts so that the distribution of weights may be altered before the ship gets completely out of trim. Some types of vessels down by the head are almost impossible to bring back into trim. Each master knows the peculiarities of his particular vessel regarding the distribution of weight for the best stability and trim; therefore, he must be consulted before deciding upon the final plan.

27. FULL AND DOWN

a. A full and down condition (par. 21*e*) is the ultimate objective of all cargo planning. Steps which must be taken to produce this condition are as follows:

(1) Determine the space available for cargo (fig. 12).

(2) Determine the cargo deadweight tonnage (par. 23*c*). Proper interpretation of the load line markings (fig. 11) is necessary to correctly determine the weight which may be loaded.

(3) Determine the VSF (par. 21*b*).

(4) Distribute the weight by dividing each cargo compartment by the VSF (par. 24).

b. The weight of any deck cargo must be deducted before obtaining the VSF.

c. To produce a full and down condition, it is desirable to have a considerable amount of cargo available for loading in order to have a variety from which to select. The "topping off" formula, as explained in paragraph 29*b* (3) (*d*), is used to fill each compartment to capacity.

Section II. CARGO PLANNING

28. STEPS IN CARGO PLANNING

a. As soon as the cargo planner has been notified of the proposed loading of a vessel, certain information and data must be obtained in order to properly plan the loading.

(1) *Vessel data.**

(*a*) Type of vessel.

(*b*) Number and size of hatches.

(*c*) Capacity and location of cargo booms.

(2) *Vessel carrying capacities.*

(*a*) Bale cubic capacity—456,525 cubic feet (fig. 12).

(*b*) Deadweight tonnage—10,805 long tons (fig. 11).

(*c*) Weight of fuel, water, stores, etc. (par. 23*c* (2)).

	Long tons
Fuel	1,700
Stores	340
Water	240
Dunnage	100
Total	2,380

(*d*) Cargo deadweight tonnage—8,425 long tons (vessel deadweight less fuel, stores, etc.) (pars. 19 and 23*c* (2)).

(*e*) Estimated deck cargo space—40,000 cubic feet.

(*f*) Seasonal load draft for this particular voyage—28 feet 6¾ inches (fig. 11).

b. The information contained in *a* above will apprise the cargo planner of the limitation to be placed on the weight and size of the cargo and will indicate the total amount which can be loaded. From this information it is apparent that cargo weighing 8,425 long tons (*a* (2) (*d*) above) and having 456,525 cubic feet (*a* (2) (*a*) above) may be loaded. The cubic capacity does not include an allowance for broken stowage. But if it is assumed that the broken stowage will average 15 percent (par. 21*c*), the cubic capacity will be reduced to a net of 388,046 cubic feet.

c. The cargo, listed in table I, is typical of that available for shipment.

d. The following is an analysis of cargo and vessel capacities:

		Cubic feet
Vessel capacity	8,425 long tons	456,525
On deck (estimated)	110 long tons	-------
15 percent allowance for broken stowage	----------	68,479
Under deck capacity	8,315 tons	388,046
Cargo engaged	7,430 tons	386,283
Lifting capacity not used	885 tons	1,763

*May be obtained from the "Stowage and Capacity Booklet" published by the U. S. Maritime Commission for the particular design involved, from the local Military Sea Transportation Service (MSTS) representative, or by radio from the vessel itself.

Table I. Under Deck Cargo

Amount	Service	Commodity	Weight (tons)	Cubic feet	Stowage factor
4,820 pcs	Eng	Steel plates	1, 574	15, 740	10
9,158 bxs	Ord	Cartridges, links and cones.	370	9, 250	25
1,800 bxs	Sig	Misc supplies	180	7, 500	42
40,100 ctns	QM	Canned vegetables	975	46, 800	48
1,980 pkgs	QM	Canned juice	596	30, 396	51
1,750 bdls	QM	Clothing	377	17, 626	47
2,000 bxs	AF	Spare parts	384	28, 180	73
1,000 bxs	QM	Canned milk	92	4, 048	44
2,383 drms	QM	Lubricating oil	500	25, 500	51
9,672 ctns	QM	Dried fruit	125	6, 500	52
10 ea	Ord	Tanks, M–46	420	22, 240	53
525 bxs	Navy	General cargo	145	8, 830	61
1,500 bxs	Ord	Automotive spare parts	417	22, 285	53
5,000 bxs	AG	Publications and forms	307	17, 806	58
1,944 ctns	QM	Rations, K	37	2, 527	71
100 bxs	TC	Marine spare parts	90	8, 750	97
5,427 ctns	QM	Eggs, dried	153	14, 076	92
500 bxs	Med	Misc supplies	32	2, 688	84
65 bxs	Ord	Vehicles	302	26, 670	87
600 bxs	A&AFES	PX supplies	41	3, 500	85
4,000 pcs	Eng	Lumber	85	8, 615	93
110 crts	AF	Aircraft parts	87	10, 700	123
12 ea	Ord	¼-t, 4 x 4 trucks	12	2, 964	247
10 ea	Ord	2½-t, 6 x 6 trucks	48	14, 680	306
6 bxs	Eng	Machinery	21	6, 680	318
300 bales	QM	Blankets	60	21, 732	362
		Total cargo under deck.	7, 430	386, 283	52
		Deck Cargo			
12 ea	Ord	2½-t, 6 x 6 trucks, M–34.	60	7, 100	------
2 ea	Eng	Landing craft, mechanized (LCM).	50	25, 670	------
		Total cargo on deck.	110	32, 770	------
		Total under deck	7, 430	386, 283	------
		Total cargo	7, 540	419, 053	------

e. In order to distribute the weight under deck, the vessel stowage factor (VSF) must be used (par. 24). In this particular instance, the VSF is obtained by dividing the bale cubic capacity (456,525) by the weight of the cargo to be loaded under deck (7,430 long tons), arriving

at a stowage factor of 61.4. The cubic capacity of each cargo compartment, as illustrated in table II, is divided by the VSF to obtain the tonnage which may be allocated to each compartment. It will be noted that the prorated weight totals 7,436 long tons which is 6 long tons over the actual weight (7,430) to be loaded. This is a result of using round numbers. In this case, the 6 long tons will be deducted from No. 4 lower hold.

Table II. Weight Distribution

Hold number	Cubic capacities [1]	VSF	Tons
No. 1 Fo'c's'le deck	22, 045	61. 4	359
'Tween deck	23, 785	61. 4	387
Lower hold	27, 910	61. 4	455
No. 2 Upper 'tween deck	27, 010	61. 4	440
'Tween deck	21, 805	61. 4	355
Lower hold	27, 945	61. 4	455
No. 3 Upper 'tween deck	45, 555	61. 4	742
'Tween deck	37, 795	61. 4	616
Lower hold	52, 840	61. 4	861
No. 4 'Tween deck	49, 200	61. 4	801
Lower hold	51, 100	61. 4	832
No. 5 'Tween deck	43, 630	61. 4	711
Lower hold	25, 905	61. 4	422
Total	[2] 456, 525	------	7, 436

[1] The capacities of the various compartments are shown in figure 12.
[2] Cubic feet.

f. The following information is entered on the weight distribution plan, as shown in figure 14:

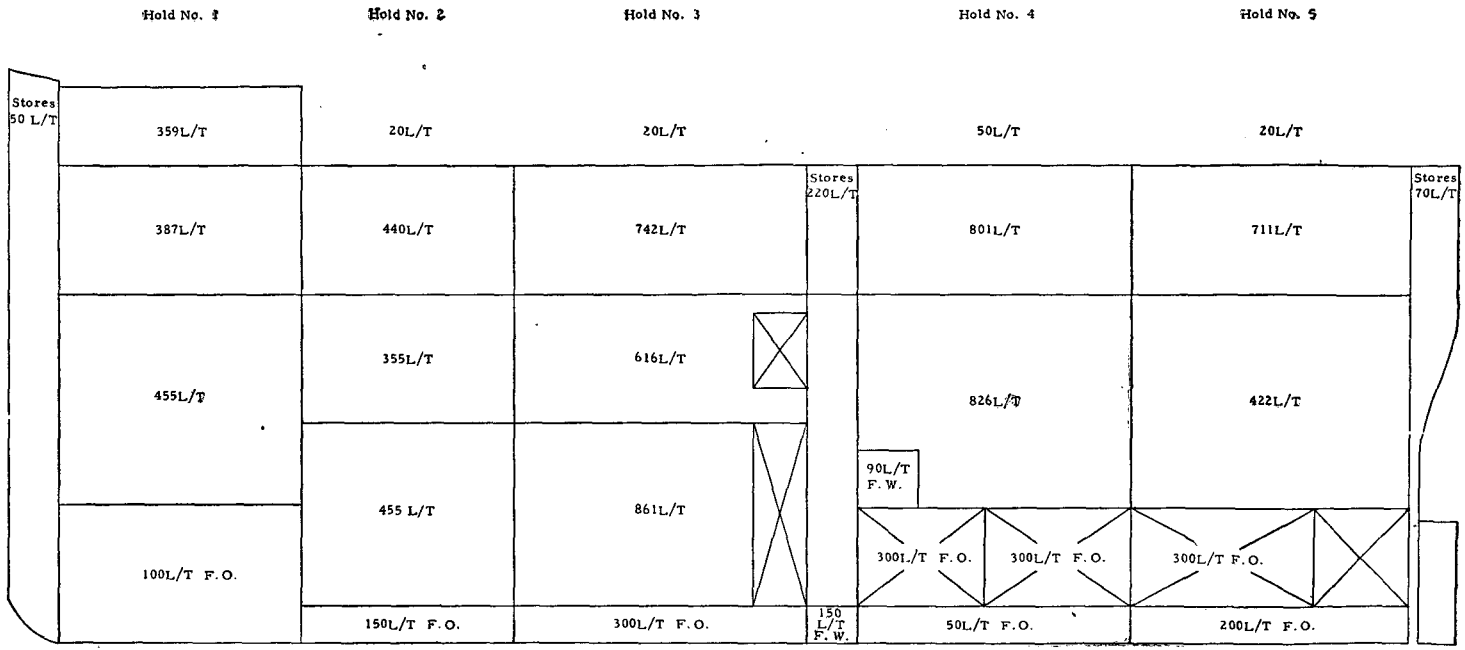
(1) Distribution of the cargo weight.
(2) Location of fuel, water, and stores on the vessel (*a*(2) (*c*) above).
(3) Weight of the deck cargo. Tentatively, the plan is to place four trucks each on hatches No. 2, No. 3, and No. 5 and the two landing craft, medium (LCM) on hatch No. 4.

g. In order to assure that the distribution of weight, as indicated in figure 14, will give the proper drag, a table (fig. 15) is prepared using the trimming scale shown in figure 13. Refer to paragraph 26 for the method of preparing the table. In this case, the drag is 40 inches which is sufficient.

29. LOADING PLAN

Though a loading plan is not firm and more than likely will be changed several times during the actual operation, a plan for each vessel must be prepared before the actual loading. Changes may be

WEIGHT DISTRIBUTION PLAN



NOTE: L/T = long tons.
F.O. = fuel oil.
F.W. = fresh water.

Figure 14. Weight distribution plan.

ESTIMATED TRIM

Compartment		Stores forward	Hold No. 1	Hold No. 2	Hold No. 3	Amidships	Hold No. 4	Hold No. 5	Stores Aft
Tonnage		50	1,301	1,420	2,539	370	2,417	1,653	70
Immersion per 100 L/T	Forward	+11.9	+9.7	+7.2	+4.1	+ 1.0	-2.2	-5.9	-8.3
20-ft scale	AFT	-8.1	-6.1	-3.2	+0.1	+3.3	+6.6	+10.4	+12.9

Forward		AFT	
+	-	-	+
6.0	53.1	4.1	2.5
126.1	97.5	79.4	12.2
102.2	5.8	45.4	159.5
104.1			171.9
3.7			9.0
342.1 in.	156.4 in.	128.9 in.	355.1 in.

185.7 in. 226.2 in. 40-in. drag

Figure 15. Estimated trim of vessel.

caused by inclement weather, nonavailability of cargo at the time needed, or other situations, sometimes unavoidable and sometimes avoidable, but which, nevertheless, are present at almost every vessel loading. However, a loading plan is necessary in ordering cargo to the pier, ordering equipment to handle the cargo, and in general planning for the operation to prevent delay. Based on information in paragraph 28, a loading plan indicating the distribution of weight and the proposed stowage is outlined in *a* through *d* below. Steps in preparing the plan are as follows:

a. Analysis of Cargo. Upon analysis of the cargo scheduled for loading, the following types requiring special consideration are found:

(1) *Heavy lifts.*

10 tanks, M46	42 long tons (L/T) each
4 LCM's	25 L/T each

A check of the boom capacities shows that the 50-ton boom at hatch No. 3 can handle the tanks and that either jumbo boom can handle the LCM's (par. 28*f*(3) and fig. 25). When deciding upon heavy lifts consideration must be given to whether the discharging port will be able to handle heavy lifts when placed on the vessel with other than her own equipment (par. 156).

(2) *Weight cargo.*

	L/T	*Cu ft*
Cartridges, links, etc	370	9, 250
Signal supplies	180	7, 500
Canned vegetables	975	46, 800
Steel	1, 574	15, 740
Lubricating oil	500	25, 500

The use of the term "weight" or "bottom cargo" should be understood to mean cargo that is suitable for hold cargo but which, under certain conditions, may be used in the 'tween decks or on deck.

(3) *Filler cargo.*

	L/T	*Cu ft*
Clothing	377	17, 626
Dried fruit	125	6, 500
Canned juice	596	30, 396
Publications	307	17, 806

The term "filler" cargo is usually applied to cargo used to "top off" larger packages where restricted headroom and limited space require the use of cargo of small dimensions to minimize lost space. The term "filler" should not be assumed to mean cargo to fill in holes or chock cases of machinery, trucks, etc. It should be considered cargo for "topping off" in holds, decks, and between beams in the squares of hatches

where it is not subject to undue pressure, dragging, or possible damage as a result of its stowage. When a small package, well-constructed to carry its weighty contents, is available, it can be properly used, when carefully protected by dunnaging, to chock cases of machinery and trucks.

b. Allocation of Cargo. Based on the distribution of weight as shown in figure 14 and the cubic capacities of the compartments as shown in figure 12, the cargo is allocated to a specific compartment.

(1) The following considerations must be made when such cargo is allocated:

(*a*) Deduct allowance for broken stowage from the cube of the compartments. In this case 15 percent is used.

(*b*) Allocate cargo by weight and cube to assure that maximum space is utilized.

(*c*) Stow like items together to reduce delay in discharging and the possibility of error in checking.

(*d*) Place heavy lifts within reach of the proper booms.

(*e*) Keep items of other services (Navy, Air Force, etc.) together if possible.

(*f*) Items requiring special handling, such as post exchange cargo, should be stowed in a safe place.

(*g*) Care must be taken not to exceed the weight per square foot allowable.

(2) In paragraph 28*e*, the VSF for each compartment was determined as 61.4. This, however, does not take into consideration the allowance for broken stowage. To find the stowage factor which will include the allowance for broken stowage, deduct the allowance (15 percent in this example) from the cubic volume of the compartment and divide the balance by the weight allocated to it, or deduct 15 percent from the stowage factor already obtained (61.4). In this case, the factor is 52.2.

(3) In loading general cargo, the cargo stowage factors will differ widely, and it will be necessary to load more than one commodity in the compartment to obtain the proper ratio between weight and space.

(*a*) The weight or bottom cargo should first be distributed in the hold of the vessel and then, taking into consideration the capacity of the booms and the headroom available, items of cargo requiring special attention, such as the M–46 tanks, should be placed in a compartment where the jumbo boom can be used. See paragraph 29*a* (1).

(*b*) Inasmuch as the stowage factors for both the cargo and the cargo compartments are known, the cargo may be allocated to a compartment by stowage factor.

(*c*) In order to plan for the loading of several different commodities in one compartment, the number of tons of each commodity should be multiplied by its stowage factor to obtain the cubic feet occupied by that tonnage.

(*d*) In the event there is still space in the compartment for additional tonnage, use of the "topping off" formula will assist the planner to fill the unused space. This formula may be used with two commodities having larger and smaller stowage factors than the space to be filled. The number of tons of the lighter commodity to be stowed is determined as follows:

Cubic capacity of space to be filled	$=V$
Stowage factor of denser commodity	$=A$
Tonnage capacity of space	$=T$
Stowage factor of lighter commodity	$=B$
Number of tons of lighter commodity to be stowed	$=X$

$$\text{Thus, } X=\frac{V-AT}{B-A}$$

For example:

$V=22{,}030$ cubic feet

$A=30$

$T=475$ long tons

$D=55$,

or

$\frac{22{,}030-(30\times 475)}{55-30}=\frac{22{,}030-14{,}250}{25}=311$ long tons of lighter commodity which may be loaded. The balance of the space will be filled with 164 long tons of the denser commodity which, combined, will fill the unused space.

c. Adjusted Trim. It will be noted that the weights as allocated to the holds do not coincide with the weights shown in figure 14. This is caused by the physical characteristics of the cargo itself. Using the trimming scale (fig. 13) and the estimated trim (fig. 15), the drag should be adjusted to reflect the new distribution of weight. In this case, the adjusted drag is still 40 inches.

d. Cubic Capacity. The cubic capacity of a cargo compartment is the major governing factor for allocating cargo. Since it is the practice to stow or "nest" small items of cargo or vehicles in the bodies of larger vehicles in order to save space, the cargo planner must be careful to estimate his cubic space on the basis of the measurement of the larger cargo only, and not on the basis of two separate cubic space computations. Although the result is the saving of valuable space, a close record of any such operation should be maintained. For an example of this type of stowage, refer to No. 4 lower hold, figure 16.

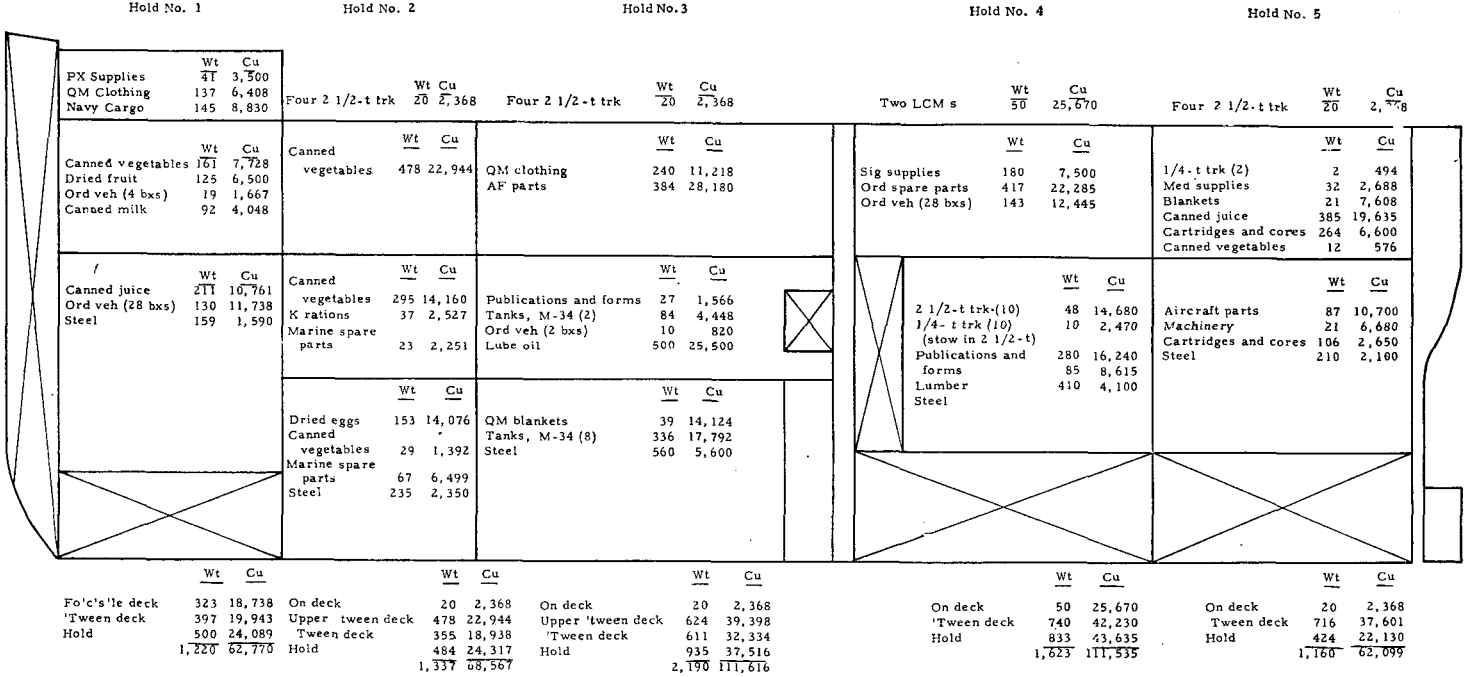


Figure 16. Loading plan.

Section III. CARGO RECEIPT AND VESSEL LOADING

30. ORDERING OUT CARGO

Thus far in regard to planning, only the relation between the cargo engaged for the vessel and the actual stowage has been considered. There is, however, another important phase of cargo planning—the manner in which the cargo is ordered out of the depot or port warehouse. In order to keep the berthing space liquid, cargo must be kept moving as planned. The bottleneck created by piers and wharves filled to capacity or badly congested with vehicles loaded with cargo seriously retards the loading of vessels and greatly reduces the port capacity.

a. Cargo is delivered by railroad cars, lighters, trucks, etc. Heavy-lift cargo has to be delivered at a specified time in order to coordinate the use of heavy-lift floating equipment working alongside, while other cargo is being delivered on floating equipment.

b. When delivered, the cargo is placed on the pier as close to the vessel berth as conditions will permit. The usual procedure, after the date and hour have been determined for the vessel to start loading, is to have the cargo known as bottom cargo ordered out and made available 1 day before the vessel is actually ready to start loading. For a limited time before that, filler cargo is assembled on the pier to be used when needed. To function smoothly, this operation requires coordination and proper timing. Loading a ship demands the cooperation of all concerned, if any degree of efficiency is to be maintained.

c. The lack of coordination in properly ordering out cargo for a ship will result in delays in loading, stevedore stand-by time, and unnecessary congestion on the pier.

31. LOADING HOURS

Determining the gang-hours required to load a vessel is fairly easily done, if the efficiency of the particular location in which the vessel is to be loaded has been established. Port speed in handling cargo varies as much as from 25 to 30 percent. Moreover, within ports themselves, one section will function 20 percent more efficiently than another. It is, therefore, evident that one must be familiar with the labor in a locality and with its ability to produce before attempting to predict the loading time required for a vessel.

a. Assuming that the established rate is 15 long tons per gang per hour (par. 5), it will be necessary to utilize approximately 503 gang-hours to load 7,540 long tons of cargo without the necessary time for the lashing and chocking that must be done after all cargo has been loaded.

b. As an example, assume that a vessel on berth must be ready to load on the first day of a month and must be ready to sail at midnight

of the seventh, which means that cargo loading must be completed not later than 0800 hours on the seventh to allow sufficient time to chock and secure cargo on or below deck. For the purpose of this example, assume that 1 day is sufficient for chocking and securing.

(1) In order to plan for the operation, calculations similar to the following may be made—

On-berth time—7 days
Time necessary for chocking, lashing, etc.—1 day
Loading cargo—6 days
Weight tons to be handled—7,450 long tons
Loading time—6 days
Average tons necessary per day—1,242 long tons
Average gangs on vessel per day—7 (2 hatches are double rigged)
Average weight tons required per gang per day—177
Average weight tons per hour—15
Average hours per gang per day necessary—12 hours

(2) If the cargo in the vessel were distributed equally in each hold and the tons per hour on all commodities were constant, estimating the working time would be fairly easy and accurate. However, that is not the case. The particular vessel in this example has the following weight distribution—

Hatch	*Tonnage*	*Average tons per hour*	*Hours required*
1	1, 220	15	82
2	1, 397	15	90
3	2, 190	30 (double rigged)	73
4	1, 623	30 (double rigged)	55
5	1, 160	15	78

(3) To further complicate the loading problem, the rate of loading will vary with each commodity; and nearly all of the cargo which moves at a fairly fast pace will be loaded first, leaving the slow-handling "topping off" cargo to the last. Therefore, it is necessary to push the loading during the first days to allow for contingencies, such as break-down of equipment, weather conditions, nonarrival of cargo, etc.

(4) As shown in *b* (1) above, each hatch gang will be required to work 12 hours to produce the required tonnage. However, previous experience has shown that men are not able to work over 10 hours per day and maintain their efficiency. Therefore, it will be necessary to use relief or night gangs to complete the operation in the required 6 days. Assume that the normal hours of work are from 0700 to 1600 with a possibility of lengthening the shift to 1800 hours:

Hold No.	Tonnage	Av. tons per hatch per gang-hour	Total hours required	Hours (8-hr day)	Add. hours	Hours (10-hr day)
1	1, 220	15	82	48	34	60
2	1, 337	15	90	48	42	60
3	2, 190	30 (2 gangs)	73	48	25	60
4	1, 623	30 (2 gangs)	55	48	7	60
5	1, 160	15	78	48	30	60

(5) From the above table it is seen that No. 2 hold will be the "long hatch" as it requires more hours to complete than the others. By working six 8-hour days and five and one-half 8-hour night shifts, the vessel will be completed on time. Constant checks during loading must be made to forestall any delays and to insure that the required tonnage will be produced.

32. FINAL STOWAGE PLANS

(fig. 17)

When the vessel has been loaded, a final stowage plan is prepared showing the location in the vessel of all the cargo loaded. At the same time, an Army-Navy stowage list or hatch list is made for each cargo compartment showing the number of pieces, item, weight, and cube of all cargo in that compartment. Theoretically, the final stowage plan should agree with the loading plan; but, for reasons mentioned in paragraph 29*d*, this is seldom the case. It will be noted, for example, that the cube of the cargo loaded in No. 6 hold (fig. 17) exceeds the capacity of that compartment. Ten ¼-ton trucks were loaded into ten 2½-ton trucks and, while their cube is figured into the total, do not actually take up space in the comparatment.

33. TYPES OF LOADING

a. General. The sequence in which cargo is loaded determines the sequence in which the supplies and equipment will be discharged. The cargo planner must be able to load a vessel so that it may be discharged to meet the requirements of any given mission, because each particular mission varies in the type of units, supply and equipment, and priority of discharge.

b. Unit Loading Methods.

(1) *Combat loading.* The loading of an assault unit, together with its essential combat equipment and initial combat supplies, in a single ship in such a manner as to permit immediate and rapid debarkation in a desired priority for landing attack is combat loading. In combat-type loading, emphasis is placed on the cargo's availability for rapid discharge in the proper priority, regardless of wasted space or tonnage carried.

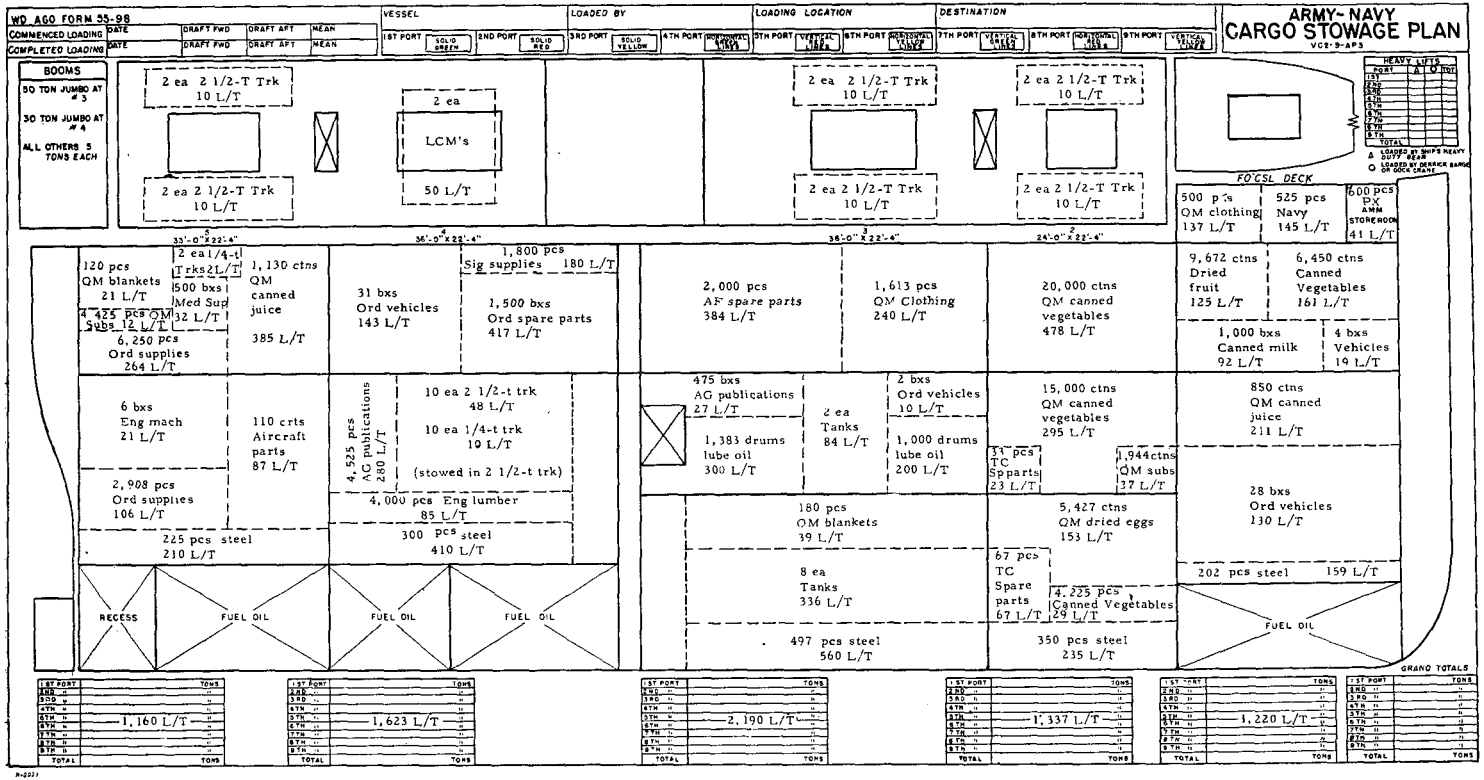


Figure 17. Final stowage plan.

(2) *Unit loading.* The loading of a unit with its equipment and supplies on the same ship without consideration of priority of discharge is unit loading. This type of loading is concerned with the utilization of the ship's weight and carrying capacity; however, because of the nature of organic equipment, it is seldom possible to utilize the ship's cargo deadweight tonnage. Every effort must be made to utilize all available space in an attempt to bring the vessel down to her marks.

(3) *Convoy loading.* The loading of units with equipment and supplies in ships of the same convoy, but not necessarily in the same ship, is convoy loading. This is a most economical utilization of cargo carrying capacity of all types of unit loading.

c. *Commercial Loading.*

(1) *Bulk and general cargo loading.* The stowage of cargo to utilize the entire carrying capacity of a vessel is bulk and general cargo loading. It permits maximum economy in shipping space but requires additional labor and facilities at destination for segregation and assembly of supplies.

(2) *Multiple port discharge.* Stowage of supplies for more than one destination is multiple port discharge. Cargo is loaded so as to maintain availability for discharge of proper items in order of arrival at the ship's scheduled destination. "Overstowing" in this type of loading is prevalent, and care must be taken by the original and intermediate ports to prevent this practice.

d. *Special Military Loading.*

(1) *Commodity loading.* The loading of a ship with one class of supplies or with supplies with one service only is commodity loading. This method permits discharge and clearance of supplies from a port area without delay for segregation but does not always allow the most efficient use of shipping space.

(2) *Balanced loading.* The loading of a vessel in quantities proportional to expected or estimated rates of consumption or needs for a specific number of personnel is balanced loading.

(3) *Selective discharge.* The loading of a ship with supplies to permit the immediate or ready discharge of any item is selective discharge.

CHAPTER 4

CARGO CHECKING AND DOCUMENTATION

Section I. GENERAL

34. IMPORTANCE

a. Accurate checking and tallying is essential for efficient delivery of supplies. The checker's count is the basis for the preparation of such port reports as the report on incoming cargo, stowage list, and manifest on outgoing cargo.

b. The cargo checker in the hold or on the pier assists the pier and stevedore personnel in preventing congestion and delay by being alert and attentive in his duties.

35. THE CARGO CHECKER

Accuracy, neatness, dependability, and speed are qualities a checker must possess. Accuracy in checking is of major importance to the control of supplies. Of equal importance is neatness; letters and numbers should be clear so that they will be understood immediately. All marks made by the checker must be legible and understandable. The checker should be so trained that he will be familiar, to some degree at least, with the greater part of the transportation activities in process at the port.

Section II. CARGO CHECKING

36. PROCEDURE

a. Cargo is received at an in-transit warehouse or pier by many different means. A shipment usually goes through many hands before it is loaded aboard a ship for its destination. Every time goods change hands, a physical count must be taken by a checker and a tally made in order to maintain an accurate account. Different installations may use different forms of tally, but in content they are substantially the same. A well instructed checker can work anywhere if he knows how to make a correct tally.

b. When cargo is loaded aboard a vessel, it is segregated first by port of discharge and then by service and/or commodity. From the manifest, hatch list, and stowage plan, the checker can tell what he may expect to find in the cargo compartments.

c. If the vessel is unloaded under combat conditions, checking and segregation of cargo as it comes out of the hold are at a minimum, since the plan is to discharge the vessel at top speed and move it out

to make room for another vessel and to reduce damage from possible enemy air action. The cargo is taken immediately to a dump where it is issued directly to using agencies or held pending segregation and delivery to service depots or dumps as they are established. Under normal procedure, the cargo is segregated in the hold in order to avoid mixed drafts of cargo. Care must be taken that unnecessary delay in discharging does not result from this practice. Upon being landed on the pier, depending upon the situation and the facilities available, the cargo may be stored on the pier, moved to an in-transit warehouse, or delivered to transportation of the using agency or to transportation for delivery to a service depot. The cargo is checked again as it is loaded on port clearance transportation. The pier checker and the hatch foreman should mark out in advance just how and in what sequence the cargo is to be discharged.

37. TALLY METHODS

There are several methods of recording the amount of cargo loaded or discharged, as follows:

a. By Unit. With large items of cargo, it is necessary to list separately on the tally each item of cargo and all information concerning it.

b. Block System. This system is used when cargo is being loaded in uniform drafts. A small vertical line is used to note each individual draft. When the fifth draft is reached, a horizontal line is used to cross out the four vertical lines—that is, ~~𝍸~~. Other drafts of cargo are listed in the same way.

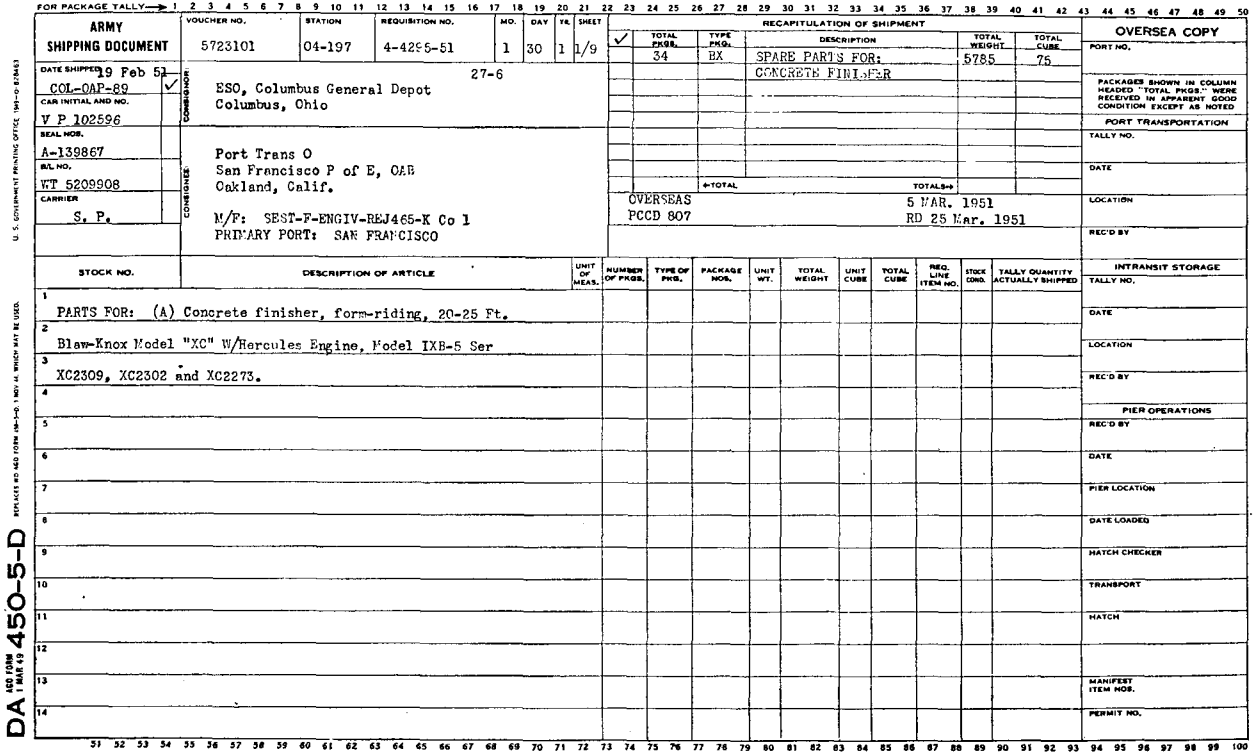
c. Straight Tally. This method is used where neither of the two systems described above can be used. This system merely records the number of items or packages in each draft, because the number of packages on each is not uniform—that is, 25–32–30–20=107.

d. Package Number Checking. This is one of the methods used in tallying a shipment carried by an Army Shipping Document. The Army Shipping Document numbers from 1 to 100 on the top and bottom margins. As each package number is checked, this is indicated by putting a line through the corresponding number. If a package is missing, its corresponding number is circled.

Section III. DOCUMENTATION

38. SHIPPING DOCUMENT
(fig. 18)

The Army Shipping Document (DA AGO Form 450–5–D) eliminates the needless repetition of common information and, at the same time, provides the information needed for each different use as the material it covers moves through the many hands necessary to get it



FOR PACKAGE TALLY → 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

ARMY SHIPPING DOCUMENT

VOUCHER NO.	STATION	REQUISITION NO.	MO.	DAY	YR.	SHEET
5723101	04-197	4-4286-51	1	30	1	1/9

DATE SHIPPED: 19 Feb 52 ✓
CAR INITIAL AND NO.: V P 102596
SEAL NOS.: A-139867
B/L NO.: WT 5209908
CARRIER: S. P.

CONSIGNOR: 27-6
ESO, Columbus General Depot
Columbus, Ohio

CONSIGNEE:
Port Trans O
San Francisco P of E, OAB
Oakland, Calif.

M/P: SEST-F-ENGIV-REJ465-K Co 1
PRIMARY PORT: SAN FRANCISCO

RECAPITULATION OF SHIPMENT

✓	TOTAL PKGS.	TYPE PKG.	DESCRIPTION	TOTAL WEIGHT	TOTAL CUBE
	34	BX	SPARE PARTS FOR: CONCRETE FINISHER	5785	75
			←TOTAL	TOTALS→	

OVERSEAS
PCCD 807

5 MAR. 1951
RD 25 Mar. 1951

STOCK NO.	DESCRIPTION OF ARTICLE	UNIT OF MEAS.	NUMBER OF PKGS.	TYPE OF PKG.	PACKAGE NOS.	UNIT WT.	TOTAL WEIGHT	UNIT CUBE	TOTAL CUBE	REQ. LINE ITEM NO.	STOCK COND.	TALLY QUANTITY ACTUALLY SHIPPED
1	PARTS FOR: (A) Concrete finisher, form-riding, 20-25 Ft.											
2	Blaw-Knox Model "XC" W/Hercules Engine, Model IXB-5 Ser											
3	XC2309, XC2302 and XC2273.											
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

OVERSEA COPY

PORT NO.

PACKAGES SHOWN IN COLUMN HEADED "TOTAL PKGS." WERE RECEIVED IN APPARENT GOOD CONDITION EXCEPT AS NOTED

PORT TRANSPORTATION
TALLY NO.
DATE
LOCATION
REC'D BY

INTRANSIT STORAGE
TALLY NO.
DATE
LOCATION
REC'D BY

PIER OPERATIONS
REC'D BY
DATE
PIER LOCATION
DATE LOADED
MATCH CHECKER
TRANSPORT
MATCH
MANIFEST ITEM NOS.
PERMIT NO.

DA AGO FORM 1 MAR 49 450-5-D
REPLACES WD AGO FORM 450-5-D, 1 NOV 44, WHICH MAY BE USED.
U. S. GOVERNMENT PRINTING OFFICE: 1951—O 874463

DA AGO Form 450-5-D (Army Shipping Document, Oversea Copy).

Figure 18. Army Shipping Document.

to its ultimate destination. Prepared by the shipper, it accompanies the shipment. It is the basic document for preparing property records, manifests, and other documentation required for the movement and control of cargo, and should indicate on the tally copy any damage, shortage, or overage each time the items change hands.

39. TALLY

A tally is the document used by the pier or warehouse checker to record the cargo. Though there is no standard form of tally, each tally, regardless of form, must show the required information. Each must be a complete history of the commodity, showing its origin and destination and also giving the authority, kind, weight, cubic measurement, and identifying marks of the packages making up the shipment.

40. CARGO MEASUREMENT

Cargo measurement is the measurement of the volume of the container or the amount of space in cubic feet occupied by an item of cargo (fig. 19). To find the cubic measurement of any piece of cargo, multiply its length by its width by its height. For example, to find the cubic measurement of a square container measuring 2 feet by 2 feet by 2 feet, proceed as follows: 2 x 2 x 2=8 cubic feet. Most containers will not be square but will have one longer side than the others. In this case, the procedure for finding the cubic measurement is the same as for a square—that is, length, by height, by width. To find the cubic measurement of such cargo as vehicles, barrels, or reels, simply square them; in other words, consider them solid squares or rectangular objects, and multiply the greatest length by the greatest width by the greatest height.

Section IV. CARGO MARKING

41. METHODS

There are three general methods of marking a shipment:

a. By shipment number—for movements of troops or special movements of supplies.

b. By shipment designators—for routine shipment of supplies.

c. By marking in the clear.

42. CODE MARKING

(fig. 20)

The purpose of code marking is to provide necessary security and at the same time to insure an uninterrupted flow of supplies to proper oversea consignees. Code marking conceals—

a. Identity of the consignee.

b. Destination of the vessel.

WEIGHT

Gross - weight of contents and container.
Tare - weight of container.
Net - weight of contents.

TO MEASURE

L x W x H - cubic.
3' x 2' x 2' - 12 cubic feet.
DISCREPANCIES between package markings and actual measurement can be determined by a check on the pier or at ship's side.
MEASUREMENTS of vehicles taken from standard published measurements should be carefully noted to include condition of vehicle shipped as to whether extending parts have been removed, tops down, etc.

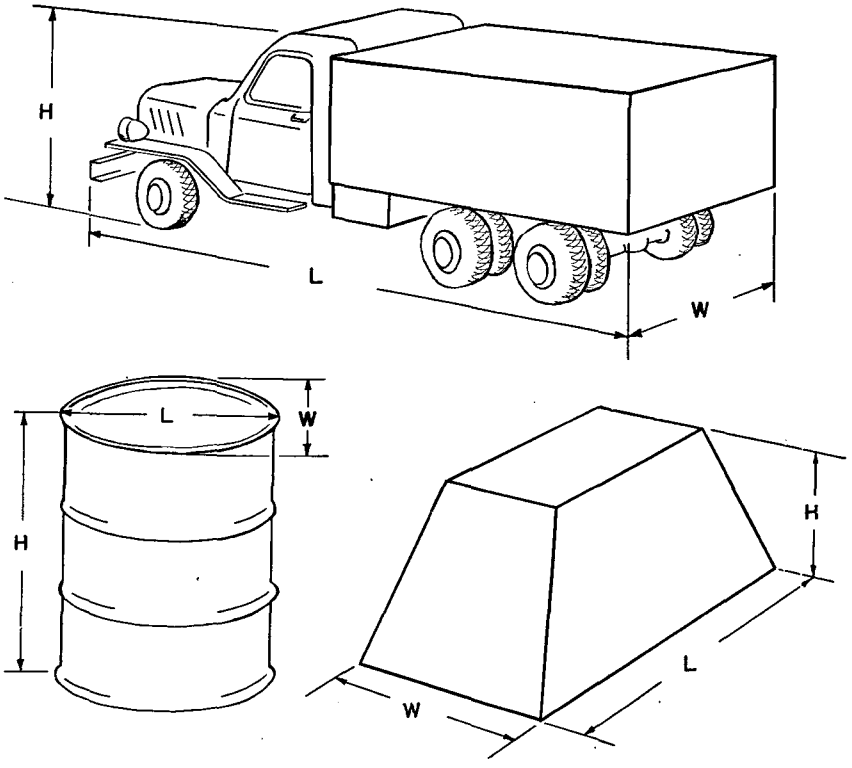


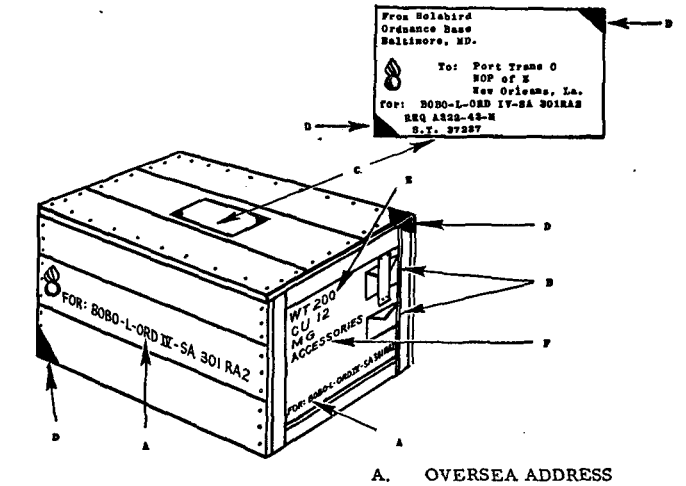
Figure 19. Cargo measurements.

c. Destination of the shipment.
d. Contents of the shipment.

43. OVERSEA ADDRESS

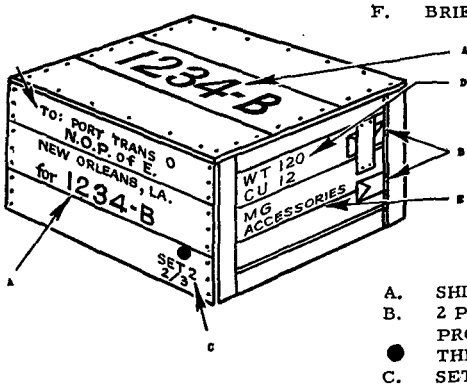
a. The oversea address is a completely coded marking used to identify a shipment and to indicate its oversea destination (fig. 21). It consists of five parts—

(1) The *first part* is primarily for the use of transportation agencies and always consists of either a shipping designator or



LABEL PREFERRED: UNNECESSARY WHEN SHIPPING IN CARLOAD LOTS.

A. OVERSEA ADDRESS
B. 2 PACKING LISTS IN ENVELOPES, ONE PROTECTED FOR USE OF OVERSEA THEATER.
C. LABEL CONTAINING DOMESTIC ADDRESS
D. SERVICE COLOR MARKINGS.
E. WEIGHT AND CUBAGE.
F. BRIEF DESCRIPTION OF CONTENTS.



A. SHIPPING NUMBER AND LETTER.
B. 2 PACKING LISTS IN ENVELOPES, ONE PROTECTED FOR USE OF OVERSEA THEATER.
C. SET MARKING.
D. WEIGHT AND CUBAGE.
E. BRIEF DESCRIPTION OF CONTENTS.

Figure 20. Code markings on boxes of cargo.

a shipment number used to identify the port or general destination.

(*a*) *Shipment numbers.* Groups of three or more digits—for example, 456 or 4567—are called shipment numbers. They are used only once and are assigned to a specific movement of units, casuals, or supplies. A letter may be added to the shipment number—that is, 4567–A—to indicate a specific subunit of the parent organization to be moved.

(*b*) *Shipping designators.* Pronounceable combinations of four letters used to represent specific theaters, ports, or areas are called shipping designators—for example, EVIL, BOBO, IRON, etc. They are used to ship supplies other

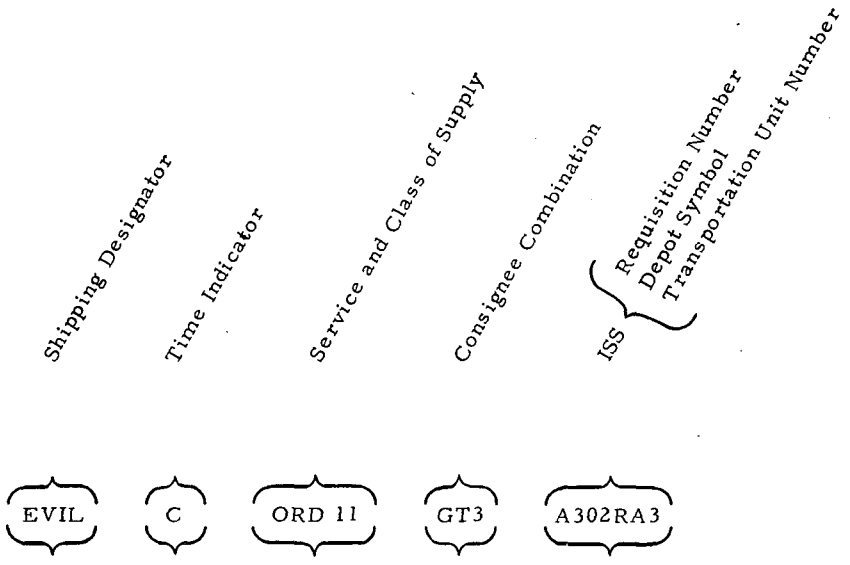


Figure 21. Oversea address.

than those included in movement orders. Since shipping designators represent permanent places, the same designation will be used repeatedly.

(2) The *second part* of the oversea address indicates at what time the consignment is to move overseas.

(*a*) This may be indicated by either a number which would identify a specific convoy or by a letter showing the half of the month of the year in which the shipment would move.

(*b*) There are 24 half months in the year lettered from A to Z (omitting O and V). Thus, A would mean the first half of January. For example, UCIP—Q would mean that the shipment would move to UCIP in the first half of August.

(3) The *third part* of the address consists of two factors:

(*a*) The *receiving service* is usually the requisitioning service—that is, Ordnance overseas requisitions and receives shipments from Ordnance in continental United States.

(*b*) The *classes of supply* are as follows:

Class I—food and forage.
Class II—unit equipment, individual and organizational.
Class III—gas, oil, and lubricants.
Class IV—special project material.
Class V—ammunition.

(4) The *fourth part* of the address provides special identification, when necessary, and is known as the consignee combination. It is usually a group of three letters to avoid confusion either with the shipping designator or with a code name.

(5) The *fifth part* of the address is the identification of the shipment and requisition number. This part of the address ties the shipment to a particular requisition.

b. The parts of the oversea address which are important to the checker are the *shipping designator* (to insure that the shipment is to be discharged at his port); *receiving service designation;* and the *class of supply.* All other parts of the oversea address have reference to a specific service depot and are not essential in the checking of cargo either from the ship or into a port in-transit warehouse. Complete information on the oversea address may be found in SR 55–730–10.

44. CODE NAMES

Code names are not to be confused with shipping designators and are never used as the addresses of shipments of supplies. They are words of more than four letters assigned exclusively by the Department of the Army "for the purpose of providing discreet and brief names for plans, projects, places and forces, and to conceal intentions in documents, communications, and discussions pertaining to these plans and operations."

45. TYPES OF MARKING

a. The most important regulations in marking are—

(1) Marking must be stenciled or painted in a conspicuous place.

(2) It must appear on more than one surface of a container.

(3) All old markings must be obliterated.

b. In addition to the oversea address, the weight and cube must be stenciled on one surface of each container.

(1) Gross weight of each container must be shown to the nearest pound.

(2) Cubage must be shown to the nearest tenth of the cubic foot.

(3) When a set is placed in two or more containers, each container must bear, in addition to its own number, the total number of containers making up the set and the number of the set within each shipment (SR 55–730–10).

46. SERVICE COLOR MARKINGS

(fig. 22)

a. Unless otherwise specified, service color markings will be shown on all export shipment containers to facilitate identification of shipments or service, and to assist in the dispersion of supplies to the proper oversea depots.

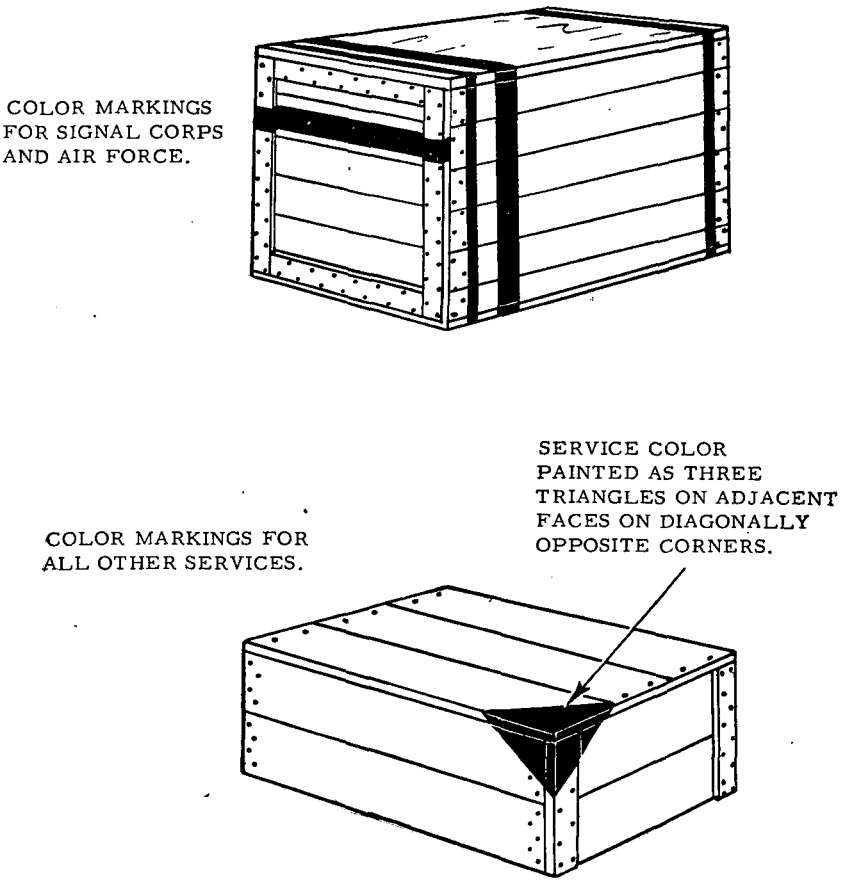


Figure 22. Service color markings.

b. Service color markings are assigned as follows:

(1) *Signal Corps.* A single 2-inch orange band painted around the small perimeter of the container parallel to the edge and located so as not to interfere with other markings indicates shipments intended for the Signal Corps. A similar orange line must be painted across each end of the container.

(2) *U. S. Air Force.* Shipments intended for the Air Force must be marked in the same manner as those intended for the Signal Corps, except that the lines will be light blue instead of orange.

(3) *Other services.* For all other shipping services, the designated color must be painted on each of two diagonally opposite corners of each container. This color must, therefore,

appear on all three adjacent surfaces of each of two diagonally opposite corners—
Chemical Corps—Cml—Dark blue
Engineer Corps—Eng—Red
Ordnance Corps—Ord—Yellow
Quartermaster Corps—QM—Green
Medical Corps—Med—Maroon
Transportation Corps—TC—Gray
Army and Air Force Exchange Service—A&AFES—Black X
Special Service—SS—White with black dot

47. MANIFEST

a. A manifest lists cargo on board a vessel according to each port of discharge. Separate manifests are prepared for each port.

b. The ship's master uses the manifest as a record of cargo on board and for presenting for clearance through customs, as required.

c. To enable the discharging port to plan for the discharging operation, copies of the manifest are flown by plane well ahead of the arrival of the vessel.

d. Two types of manifest are in use—

(1) *Transportation manifest.* This manifest includes the—

(*a*) Army ocean manifest which lists the cargo for any one port broken down by technical services.

(*b*) Manifest recapitulation which contains information relating to the vessel's characteristics, a listing of heavy lifts which the ship's gear cannot handle, weight and cube of cargo for each port of discharge, and the grand total of all cargo aboard the vessel.

(*c*) Summary of cargo which is a summarization of cargo by port of discharge and type of cargo for each technical service shown in long and measurement tons.

(2) *Supply manifest.* This manifest includes—

(*a*) The transportation manifest (*d* (1) above).

(*b*) Shipping documents for each item on the manifest placed behind the manifest page to which related.

e. SR 55–730–10 gives detailed instructions on the preparation and assembly of each type of manifest.

CHAPTER 5

ORGANIZATION OF TRANSPORTATION CORPS PORT BATTALIONS AND COMPANIES

48. GENERAL

The various types of ports are set up to operate anywhere they are needed. They provide, however, only for administrative and supervisory personnel. In order to perform missions, operating units must be assigned. Transportation Corps port, truck, and harbor craft companies are assigned to transfer cargo to or from ships, beach dumps, or transit warehouses.

49. HEADQUARTERS, PORT BATTALION
(T/O & E's 55–115 and 55–116)

A port battalion, normally assigned to a port or a task force, is capable of operating a small port, installation, beachhead, or subport. Its cargo handling capabilities are based on the number of port companies assigned (par. 5). The port battalion normally exercises command and administration over four port companies. The headquarters, headquarters service company, provides special services to port companies, such as cargo gear mechanics, blacksmiths, welders, floating crane operators, etc.

50. HEADQUARTERS, PORT COMPANY
(T/O & E's 55–117 and 55–118)

a. Port companies are normally an organic part of the port battalion. These companies may be assigned as separate units to large or medium ports. Their primary mission is the transfer of cargo from ship to shore, or the reverse. This includes all the phases of stevedoring—winch operation, stowing, and checking and handling of cargo by hand and by mechanical equipment. When necessary, personnel of the port company may be used as warehousemen, wharf crews, or in other capacities.

b. Port companies are of two types:

(1) Type A (T/O & E 55–117) is organized with a company headquarters and three operating platoons. Company headquarters provides the necessary administration for the company, and the operating platoons provide the personnel for han-

dling cargo. Where augmented, this company is provided with a service section consisting of such specialists as cargo gear mechanics, crane operators, riggers, carpenters, and welders.

(2) Type B (T/O & E 55–118) is a unit organized to provide technical and supervisory personnel trained in loading and unloading cargo. It is capable of supervising approximately 1,200 unskilled laborers. A type B port company consists of a company headquarters, a service section, a checkers section, and six operating platoons.

51. PLATOON HEADQUARTERS

Port company platoons are organized into platoon headquarters and several hatch sections. The platoon headquarters is composed of the platoon officers, stevedore foremen, cargo checkers, and other necessary personnel such as tractor operators, fork lift truck operators, etc. Each platoon in a type A or B port company consists of five hatch sections, each hatch section being a complete stevedore "gang."

52. HATCH SECTION

a. The basic operating unit of a port company is the hatch section. It is made up of the following:

(1) *Hatch foreman.* The noncommissioned officer in charge of the hatch section is the hatch foreman.

(2) *Deck crew*, (fig. 23). The winch operators and signalmen compose the deck crew.

(3) *Hold crew* (fig. 24). Longshoremen in the hold compose the hold crew.

(4) *Pier crew*, (fig. 25). Longshoremen on the pier compose the pier crew.

b. Duties of the hatch section personnel are as follows:

(1) *Hatch foreman.*

(*a*) Must know jobs of all men in section.

(*b*) Must understand cargo discharge and loading operations.

(*c*) Must recognize unsafe working conditions and know methods of correction.

(*d*) Must know principles of stowage and securing of cargo.

(2) *Winch operator.*

(*a*) Operates the ship's winches.

(*b*) Knows how to operate all kinds of winches.

(*c*) Must understand hold and pier operations.

(3) *Signalman.*

(*a*) Knows standard winch signals.

(*b*) Knows how to sling a draft, since it is his job to observe each draft of cargo as it is moved.

(*c*) Must be particularly familiar with safety regulations.

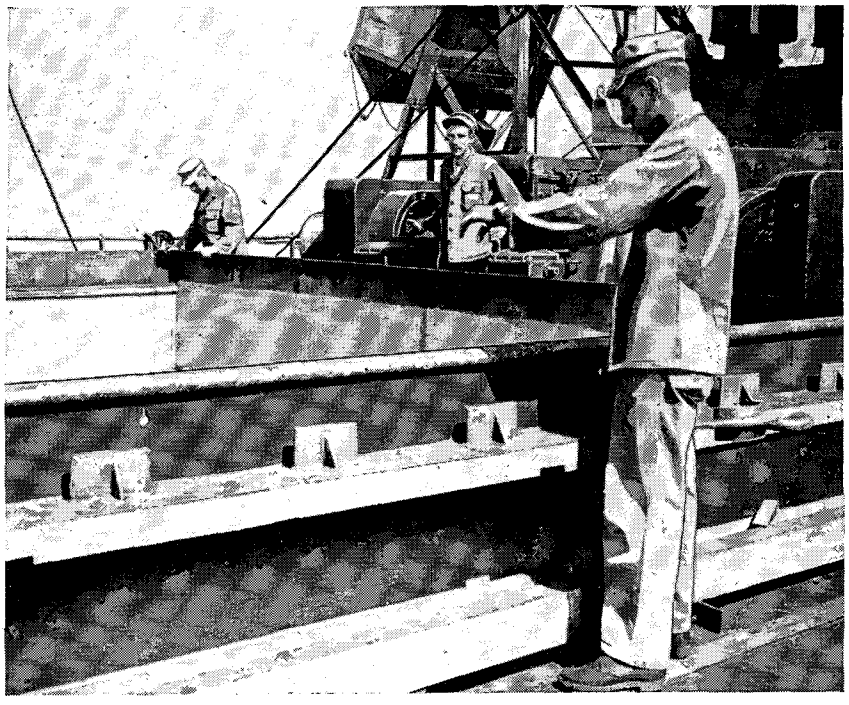


Figure 23. Deck crew.

(4) *Hold header.*

(*a*) Is in charge of the stowage of cargo in the hold of the ship.

(*b*) Must know the uses of dunnage and how to stow every type of cargo.

(5) *Hold longshoremen.* Longshoremen must know the procedures for handling cargo in the safest and fastest way.

(6) *Pier header.*

(*a*) Is in charge of moving cargo to or away from the hook.

(*b*) Must know how to operate all pier equipment.

(*c*) Must know how to sling any type of cargo.

(*d*) Must know where and how to obtain gear.

(*e*) Must know how to warehouse cargo.

(7) *Pier longshoremen.*

(*a*) Must know how to warehouse cargo.

(*b*) Must know how to unload all types of cargo.

c. The efficiency of a stevedore operation usually depends upon the ability and flexibility of the men included in the gang or section. The men should be distributed in the hold and on the wharf according to the way they operate most efficiently.

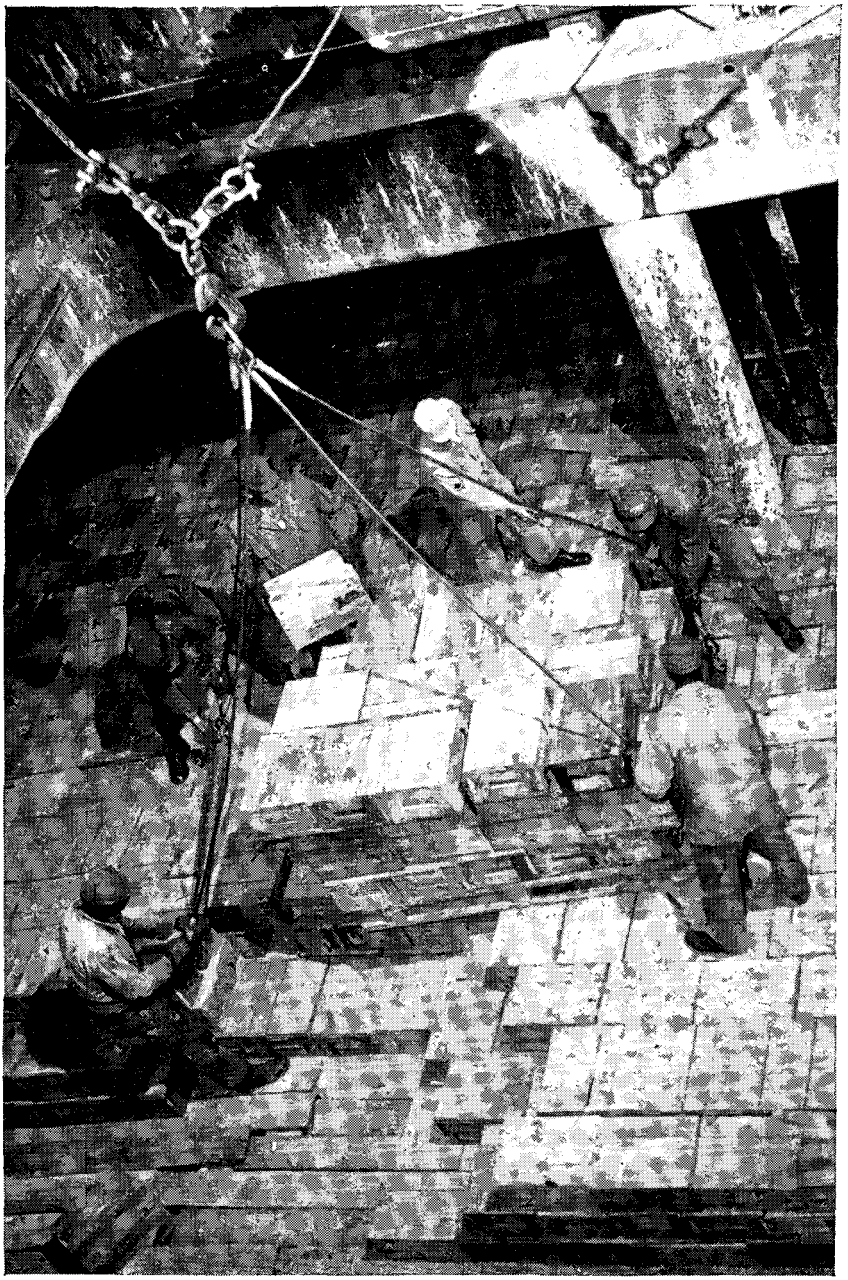


Figure 24. Hold crew.

Figure 25. Pier crew.

CHAPTER 6
RIGGING AND OPERATION OF SHIP'S GEAR

Section I. GENERAL

53. ROPES, KNOTS, AND SPLICES

a. The longshoreman ordinarily does not need a knowledge of splicing, since most of this work is done by a specialized group of men who make and maintain in good repair all ropes, wires, chains, and other gear. However, he should have a basic knowledge of the knots and splices that he may find useful in his daily operations.

b. These knots and splices are divided into the following general types:

(1) Knots made in the end of a rope.
  (*a*) Overhand knot.
  (*b*) Bowline.
  (*c*) French bowline.
(2) Knots used in joining two ropes.
  (*a*) Square knot.
  (*b*) Single sheet bend.
  (*c*) Double sheet bend.
(3) Knots in the middle of a line.
  (*a*) Sheepshank.
  (*b*) Bowline on a bight.
  (*c*) Cat's-paw
(4) Hitches.
  (*a*) Half hitch.
  (*b*) Timber hitch.
  (*c*) Blackwall hitch.
  (*d*) Sling shortener.
(5) Splices.
  (*a*) Eye splice.
  (*b*) Short splice.
  (*c*) Long splice.
  (*d*) Back splice.

c. Detailed instructions on making knots, splices, and the care and preservation of rope may be found in TM 5–225.

54. WIRE ROPE AND CABLE

As most cargo gear and lashings are made from wire rope, it is essential that the members of port companies become familiar with

the characteristics, uses, and splicing of wire rope. Riggers and longshoremen assigned to port companies must know the proper care, breaking strain, and safe working load of wire rope in order to prevent damage to cargo, danger to personnel, and delays in loading and discharging. Detailed information may be found in TM 5–225.

55. CHAIN

Common uses for chain in military operations are towing vehicles, slinging loads, hauling objects, lashing loads on trucks and cars, and lashing vehicles and cargo in the hold or on deck of a vessel or barge. Care and uses of chain are found in TM 5–225.

56. BLOCKS AND TACKLE

Blocks and tackle which change direction of pull and increase pulling or lifting power are essential in stevedoring for moving, lifting, and stowing heavy items of cargo. TM 5–225 provides detailed information on the uses, types, and capabilities of various blocks and tackle.

57. FITTINGS USED IN RIGGING

The principal types of fittings used in stevedoring operations are shackles, turnbuckles, thimbles, and clips. TM 5–225 contains details on use, care, and safe working loads.

58. RIGGING AND DECK FITTINGS

To understand rigging and operation of ship's gear, the stevedore must know the terms used to describe the various deck fittings and types of rigging. The nomenclature of ship's gear is normally divided into three sections (fig. 26).

a. Standing Rigging. This section includes all permanent fixtures, such as mast, shrouds, and turnbuckles.

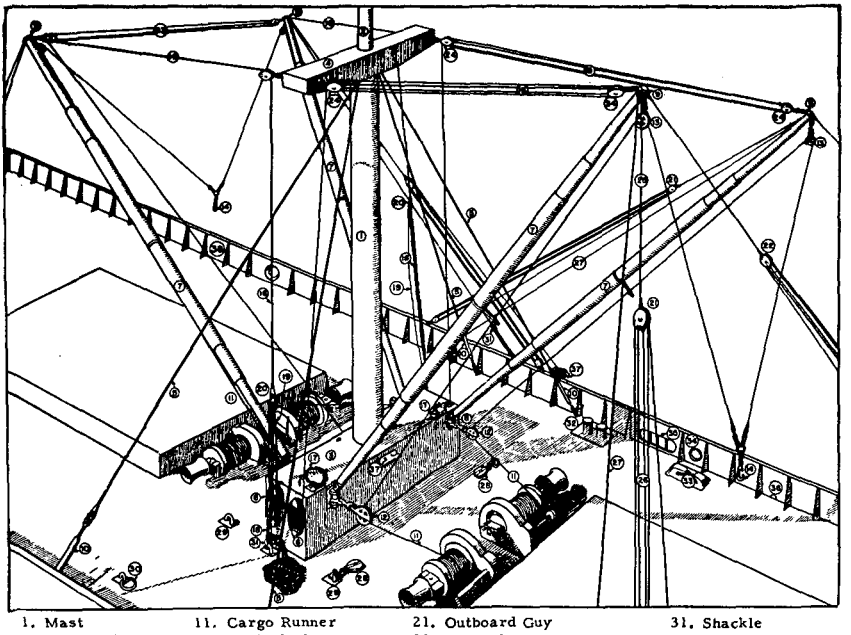
b. Running Rigging. This section includes the moving parts of ship's gear, such as runners, topping lifts, and guy tackles.

c. Deck Fittings. This section includes the devices used to secure the standing and running rigging, such as chocks, bits, and cleats.

Section II. WINCHES, WINCH OPERATION, AND SIGNALS USED

59. GENERAL

a. The most important source of mechanical power in stevedoring operations is the winch. It may be described as a power-driven machine to lift, lower, or move cargo. Power is usually derived from steam or electricity, although air or gasoline power may be encountered, particularly in training operations. Winches must be prop-



1. Mast
2. Top Mast
3. Mast Table
4. Crosstree
5. Shroud
6. Topping Lift Cleat
7. Boom
8. Gooseneck
9. Linkband
10. Turnbuckle
11. Cargo Runner
12. Heel Block
13. Head Block
14. Cargo Runner
15. Topping Lift (Multiple)
16. Topping Lift (Single)
17. Stopper Chain
18. Bull Chain
19. Bull Line
20. Bale
21. Outboard Guy
22. Inboard Guy
23. Amidship Guy
24. Topping Lift Block
25. Guy Pendant
26. Guy Tackle
27. Preventer
28. Snatch Block
29. Pad-eye
30. Pad-Eye & Ring (Ring Bolt)
31. Shackle
32. Bitts
33. Open Chock
34. Closed Chock
35. Freeing Port
36. Scupper
37. Cleat
38. Bulwark

Figure 26. Nomenclature of rigging and deck fittings.

erly maintained and competently operated or serious work stoppages will result. The fundamentals of winch operation covered in this section must be understood to insure safe, fast cargo handling. Most winches, even those made by the same manufacturer, work differently. Thus, it is of prime importance that the winchman know the winch he is to operate.

b. Winches may be grouped according to their sources of power—steam, electricity, air, or gasoline. Although steam winches are the most common today, most of the newer ships are equipped with electric winches. Air-driven winches utilizing air compressors have been used on land ships and other training devices in various training establishments and are usually steam winches modified for air operation. The air-driven winches are not used on ships. Gasoline-powered winches are common on harbor boats and other small craft.

60. USES

Primarily, the winch is used to load or discharge a ship. In addition, it is used to raise the booms to a working position and to lower

them when work is completed, to swing booms--particularly heavy lift or jumbo booms, to assist in mooring the vessel, and to shift lighters or barges alongside. The winch, also, is a definite aid in dragging heavy articles, such as vehicles or large cases in the hold, 'tween deck or on deck so that they may be properly stowed; it is the stevedore's greatest mechanical aid, enabling him to get his job done with a minimum of back-breaking effort and a maximum of time saved.

61. STEAM WINCH

(fig. 27)

a. The winch operator must know and understand the nomenclature of the winch. The following is the key to figure 27.

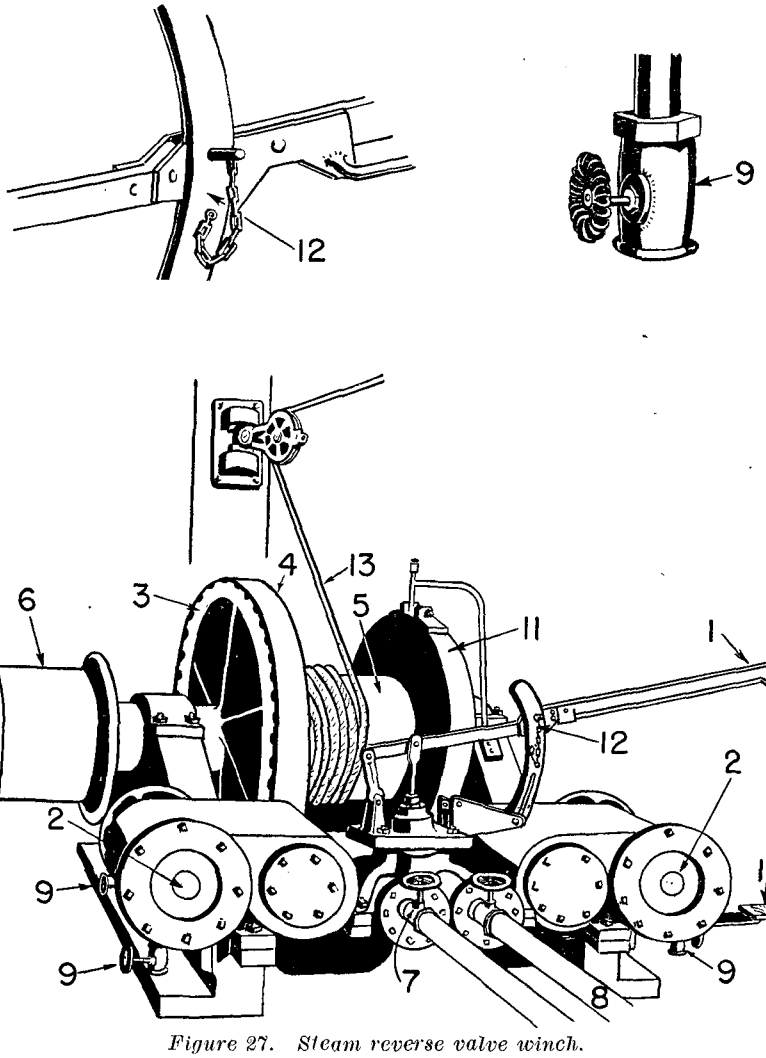


Figure 27. Steam reverse valve winch.

(1) *Control handle—1.* The lever used to operate a winch is the control lever. The handle is raised to hoist a load and depressed to lower a load. It is placed in neutral to stop the winch and hold the load.

(2) *Cylinders—2.* Steam entering the cylinders causes pistons to move, providing motive power to drive gears.

(3) *Drum gear—3.* Gear keyed to the drum or drum shaft is the drum gear; it is the final driving gear in the series.

(4) *Gear guard—4.* The protective metal covering over the gears to prevent fouling from weather and to provide safety to the operator is the gear guard.

(5) *Drum—5.* The cargo runner is made fast to the drum. Winding or unwinding action of the runner around the drum provides hoisting or lowering action of the cargo hook.

(6) *Cathead—6.* The cathead (gypsy head) is the drum end or spool and is used primarily on topping and lowering booms.

(7) *Steam intake valve—7.* When open, this valve allows steam to enter the steam chest of the winch.

(8) *Steam exhaust valve—8.* When open, this valve allows exhaust steam to escape.

(9) *Bleeder valves—9.* These valves are also known as petcocks and draincocks. They are used to drain condensed water from cylinders and/or steam chest.

(10) *Brake pedal—10.* The brake pedal is used primarily as a safety measure when the control handle in neutral fails to hold or the drum slips or creeps because of leaking valves. It is also useful in slacking loads slowly and evenly. It is very seldom used on the reverse valve winch.

(11) *Ring band—11.* The band around the flange of the drum which stops the drum by friction applied by foot pressure on the brake pedal is the ring band.

(12) *Safety lock pin—12.* This pin locks the control handle in neutral.

(13) *Cargo runner—13.* The cargo runner, also known as a whip or a fall, is made fast to the drum by use of clamps, or by round turns around the drum's shaft. It is then moused. It should be wound on the drum in such a manner as to wind up when the control handle is raised and to pay out when the handle is lowered. As a safety precaution, the runner should be of sufficient length to allow at least three round turns around the drum at the farthest point of travel.

b. A careful inspection by winchmen must precede operation of the winch. The principle points of this inspection are:

(1) Oily or slick deck where the winchman stands. A few pieces of dunnage or burlap will correct this condition.

(2) Loose or fouled runner on drum. This may cause the winch to reverse itself by allowing the runner to bind, or cause a jump in the load when the slack is taken up, thus endangering the rigging on heavy loads.

(3) Loose lines or material piled up behind the winch which may foul the gears.

(4) A loose or defective control handle. The operating handle should also be checked to see that it is in neutral position and that the safety handle is in place.

(5) Too much slack in the brake. This can easily be tested by noting the "amount of play" in the brake pedal when pressure is applied.

(6) Runner wound underneath drum. This will generally cause the runner to operate in the opposite or wrong direction.

(7) The winchman should also satisfy himself that the rigging is in satisfactory condition and that all blocks and lines are running free. Any condition that may hamper the mechanism of the winch or endanger the lives of those working should be corrected before the steam is allowed through the winch.

c. The following is the warming-up procedure in winch operation:

(1) Start by opening the bleeder valves or draincocks. There are generally two of these under each cylinder, and one under the steam chest beneath the control handle. Steam will condense into water as the winch cools from the previous operation. It is necessary to drain this water off before the winch can be operated.

(2) With bleeder valves open, the next step is to open the steam valves (both intake and exhaust) so that the steam is assured free circulation through the winch.

(3) The safety pin is next removed and the control handle lowered until the drum revolves for several turns, placing slack in the runner.

(4) The winch should now be run back and forth by alternately raising and lowering the control handle until all the water is driven from the cylinders and steam rises from the open bleeder valves.

(5) When the cylinders have been cleared of water, the handle is placed in neutral position, the safety pin is inserted, and the bleeder valves are closed. The winch is then ready for use.

d. To familiarize new winchmen with the proper sequence of preparing winches for operation, the following should be memorized:

(1) Inspect the winch.
(2) Open bleeder valves.
(3) Open steam valves.
(4) Remove safety pin.
(5) Slack off runner, and run winch back and forth.
(6) Replace safety pin, close bleeder valves, and stand by for operation.

62. ELECTRIC WINCH

a. Most modern cargo vessels, including the VC2 (Victory) type, are equipped with electric winches. The trend in modern cargo handling is away from steam winches. The EC2 (Liberty) type vessel, many of which are in operation, is equipped with steam winches.

b. Electric winches require no warm-up and are, therefore, ready for immediate use. This type of winch operates without the clatter of the steam winch. It does not require steam pipes on deck, thereby releasing more deck space for use. Moreover, the problem of freezing steam pipes is not present in the operation of electric winches. Also, unlike the steam winch, the operating controls of the electric winch do not have to be on the winch itself.

c. Running electric winches at a slow speed over long periods of time tends to make the resistors hot and will eventually burn them out, causing lost time waiting for repair. By running the winches at a faster rate and allowing them a cooling-off period approximately once an hour, the winchman can avert such break-downs.

d. The operation of an electric winch is simple. The speed is determined by the position of the control lever, amount of line on the drum, weight of the load, and the line voltage. The electric winch may or may not have a clutch or drumhead brake; however, with the lever in neutral position, the draft is braked automatically. In case of an overload, the circuit breaker cuts off the electricity, but power is cut in immediately when the control handle is returned to neutral.

63. GASOLINE WINCHES

The gasoline winch is not found on oceangoing vessels, but may be encountered on small craft or training barges. The motive power for this winch is provided by a gasoline motor. The winch itself is operated as a friction winch, and the speed is governed by the pressure applied to the lever of the winch. This winch operates rapidly and in a jerky motion; for this reason it is not well adapted to cargo operations.

64. SPECIAL-PURPOSE WINCHES

In addition to cargo winches, stevedores may also have occasion to use capstans, warping winches, and anchor windlasses aboard a vessel.

a. Capstan. A capstan is a spool-shaped vertical revolving drum fitted with ridges to prevent lines from slipping. It is constructed primarily to handle large mooring lines. Although they may sometimes be operated by hand, capstans are usually powered by steam or electricity. They are placed on the forecastle deck and on the stern where they may be used to handle tow lines. On larger vessels, additional capstans may be found forward, amidships, and aft.

b. After Warping Winch. The after warping winch is equipped with two gypsy heads (large spools or catheads) for the handling of heavy mooring lines. This winch provides a good source of power for the guys used in rigging a swinging boom at the after hatches.

c. Anchor Windlass. Primarily used in handling the anchor, the anchor windlass is found forward at the bow of the ship. It usually has two wildcats, grooved drums operating independently of one another, which grasp the anchor chains. The chain links fall into fitted grooves on the wildcat, and the chain is hauled in as power is applied, dropping the chain into the locker under the windlass. The anchor windlass is also fitted with two or more gypsy heads which are used in handling the mooring lines. The gypsy heads provide a source of power for the guys of swinging booms worked on the forward hatches.

65. WINCH OPERATION

a. Cargo Handling Methods. Present day cargo handling methods require two winches for discharging or loading cargo. The winches or winch controls may be so situated that one winchman can operate both, or the situation may require two men.

b. Discharging. Upon instructions from the signalman:

(1) Hoist draft out of hold with amidship or hatch boom winch until it clears the coaming of the hatch. The outboard winch takes up the slack on the cargo fall during the hoisting.

(2) Carry or rack draft across deck and over pier or lighter with outboard boom winch. During this operation, the hatch boom winch slacks off, maintaining just enough tension to prevent the draft from swinging.

(3) Lower draft to pier or lighter by slacking off on both winches.

c. Loading. To load, reverse instructions in *b* above.

d. Operating Hints.

(1) Avoid swinging the draft.

(*a*) Swinging can be prevented in the hold or on the pier by plumbing the draft directly under the head of the boom before hoisting.

(*b*) Swinging in midair can be controlled by waiting until the draft is at the highest point of its swinging outboard and then slacking the cargo runner on the hatch winch quickly, so that the slings supporting the draft assume a perpendicular position (fig. 28).

(2) Avoid violent starts and stops or sudden stresses. Sudden starts or stops may place a strain that will break a cargo runner, may part guys or topping lifts, or may carry away a block or bring down a boom.

(3) Keep the right amount of slack in the nonworking cargo runners.

(*a*) Not enough slack will cause the draft of cargo to strike against the side of the ship or the hatch coaming.

(*b*) Too much slack will allow loose turns to pile up on the drum.

(4) Never leave a winch unattended.

(*a*) When leaving a steam winch, replace the safety pin to avoid the handle being moved accidentally.

(*b*) Shut off steam valves to prevent creeping which will occur in a winch with leaky valves or packing.

(*c*) Shut off power on other types of winches.

(5) Avoid the "fiddle string" or straight pull which will cause—

(*a*) Excessive strain on the cargo falls as the two winches pull against each other (fig. 29).

(*b*) A torque or twisting effect on the boom (fig. 29).

(*c*) Additional strain on the guys.

(6) Long slings on a draft allowing too much drift are a cause of the "fiddle string" pull (fig. 30).

(7) As the angle between the cargo falls increases with hoisting, the strain on the falls and guys increases (fig. 29).

(8) If a "fiddle string" pull is unavoidable because of the type of cargo being handled, the single swinging boom, as described in paragraphs 79 and 87, should be substituted.

66. SIGNALS

a. A winchman, whether operating aboard a vessel or on shore, depends upon the signals given by the signalman. The safety and cadence of the operation depend upon the discretion of the signalman as to when and what kind of signals are to be given. Every man in

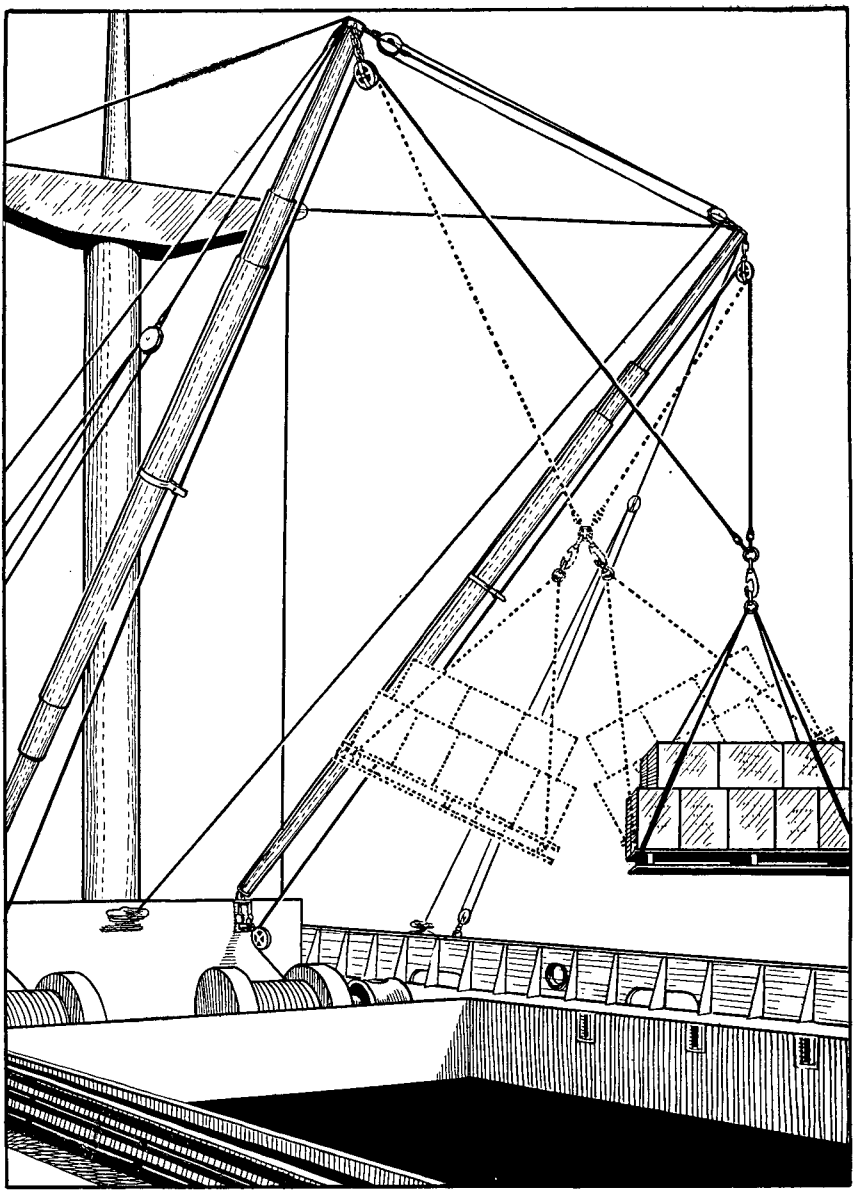


Figure 28. Checking the swing of a draft.

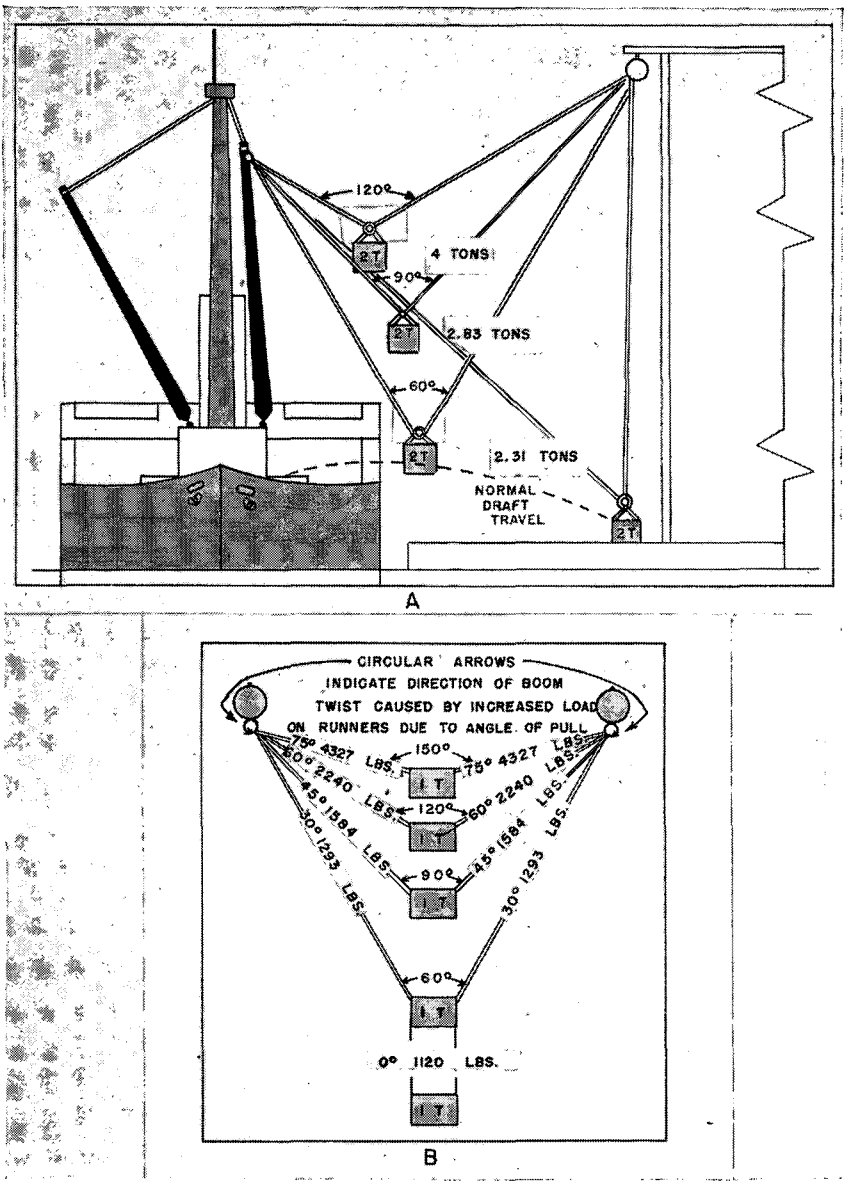


Figure 29. Strain on cargo falls.

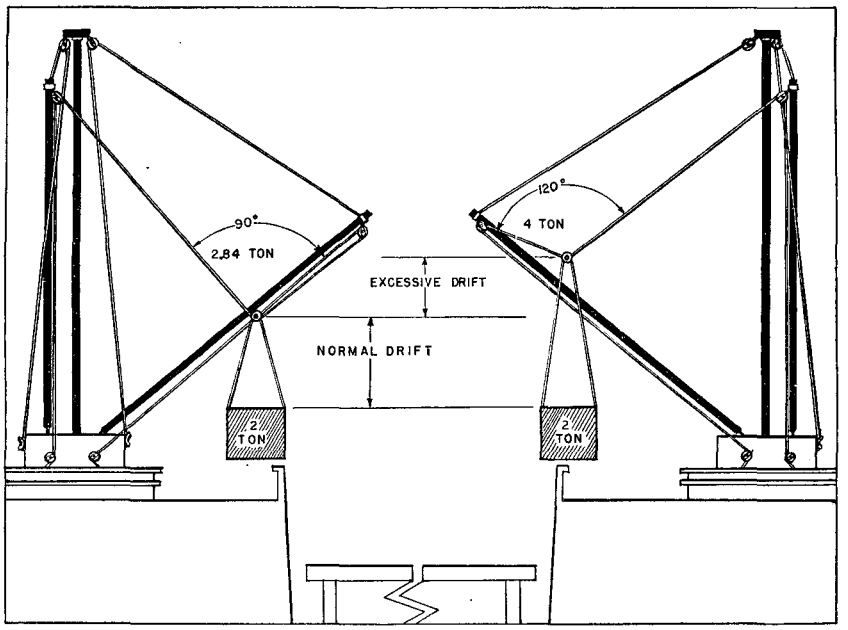


Figure 30. Strain on cargo falls caused by excessive drift.

the hatch section should be familiar with the signals used in stevedoring.

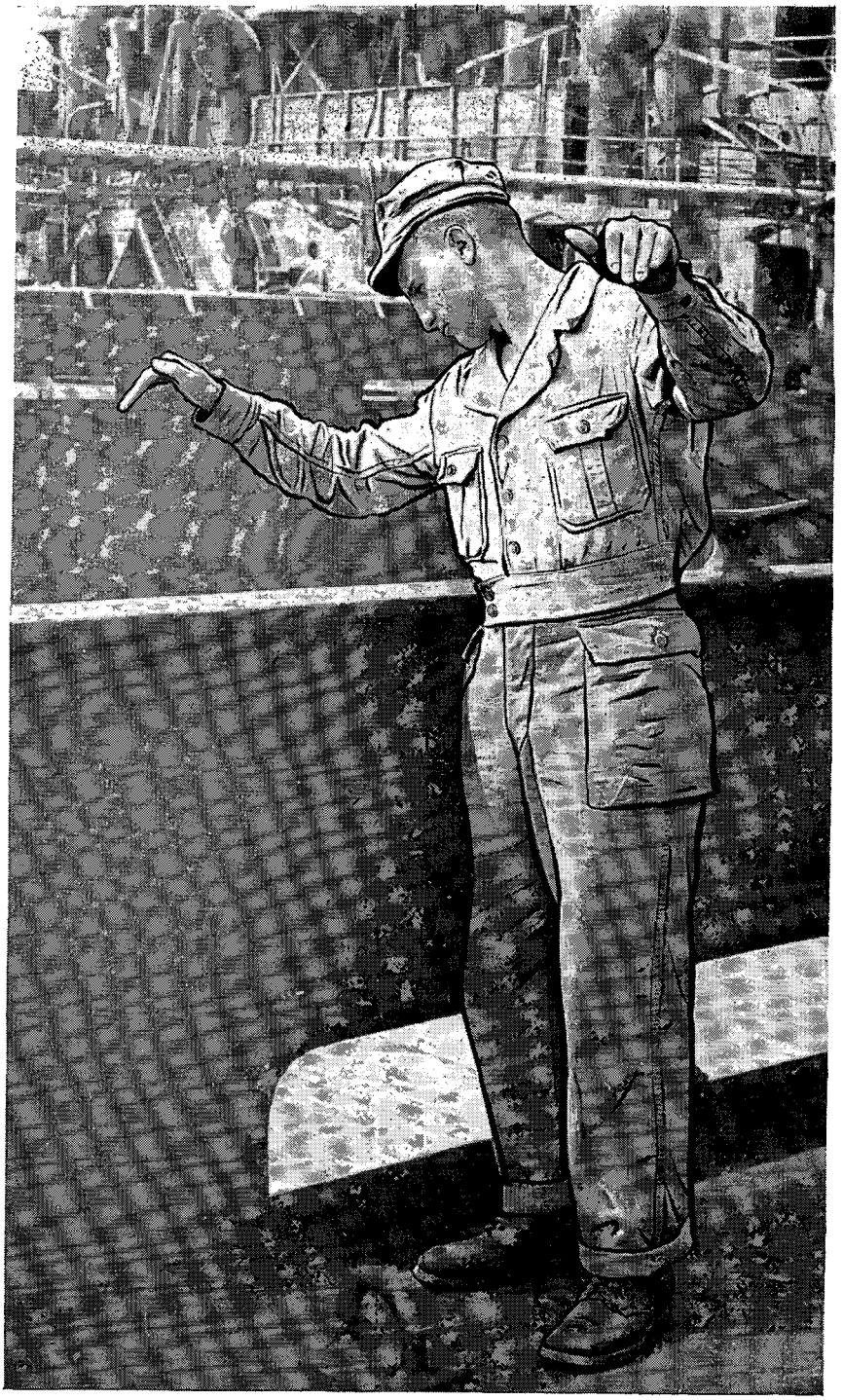
b. The signalman must realize that a few seconds elapse between the time the signal is given and the actual stopping of the winch. Allowance not properly calculated usually results in damage and accident.

c. When it is necessary for the signalman to use both hands in signaling, the signalman and the winch operators or operator must have a clear understanding as to which hand applies to which winch. In all cases, the signalman and the winch operator must clearly understand the signals in order to prevent damage to the cargo or cargo gear, accidents, and confusion.

(*d*) The standardized set of signals used is as follows (fig. 31, ①, ②, ③, and ④) :

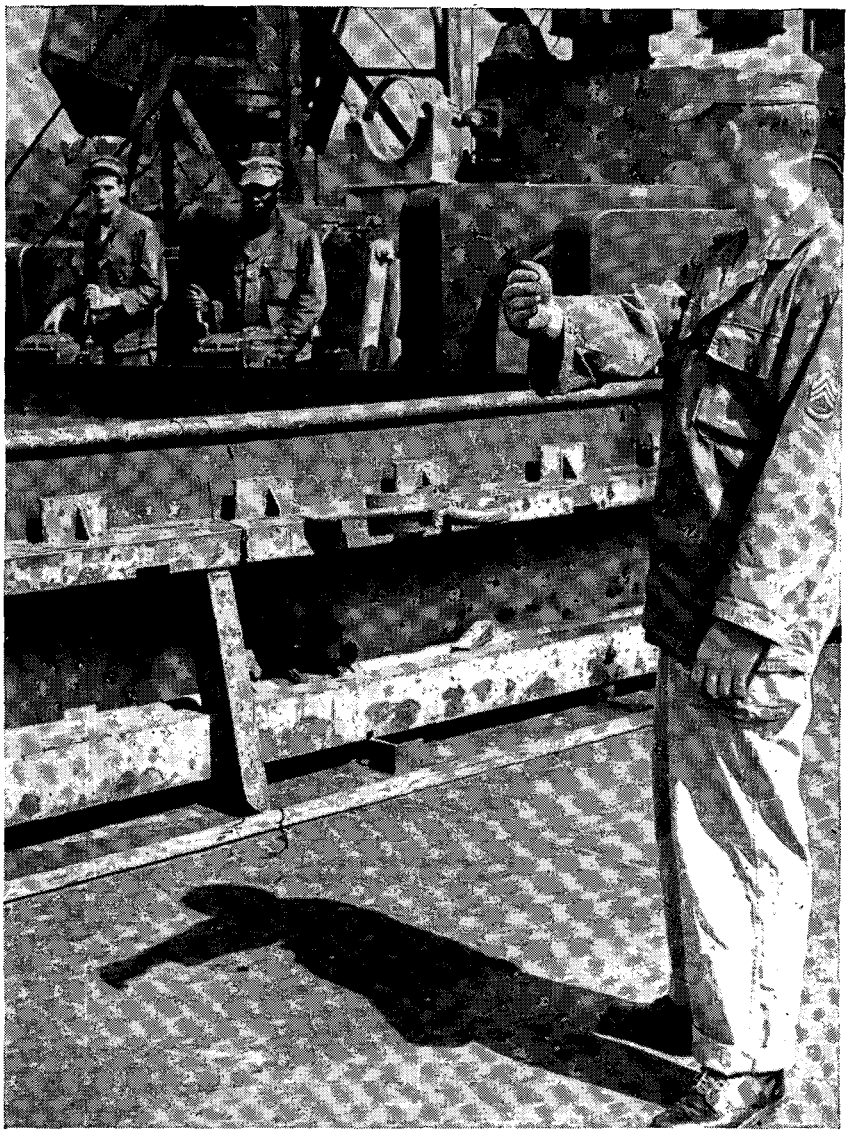
① Hoist.

Figure 31. Signals used in winch operation.



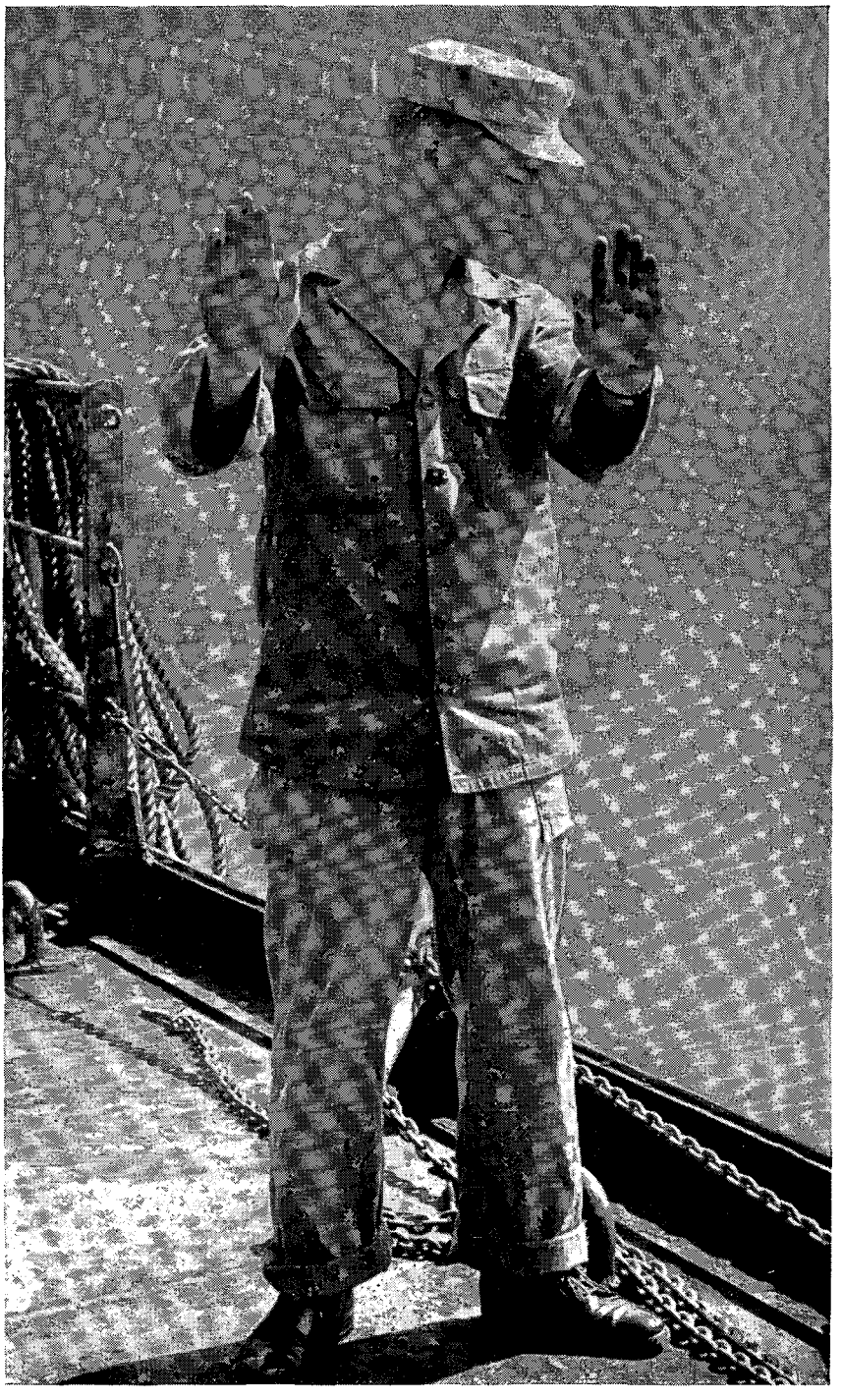
② Lower.

Figure 31. Signals used in winch operation—Continued.



⑧ Rack.

Figure 31. Signals used in winch operation—Continued.



④ Stop

Figure 31. Signals used in winch operation—Continued.

(1) *Hoist.* With hands extended, palms up, the fingers are moved upward.
(2) *Lower.* The procedure for hoisting ((1) above) is reversed.
(3) *Rack.* The arm is extended outward from the body and is crossed over in front of the body in a sweeping motion, pointing the direction in which the draft is to move. This signal indicates that the winchman should move the load at his own discretion and is given only when the draft is in full view of the winchman.
(4) *Stop.* The palm is extended forward with the fingers extended upward, palm facing the winchman.
(5) *Emergency stop.* This motion indicates a more pressing need for action. The arm is extended forward with the palm facing the winchman and is moved away from the body rapidly and emphatically.

Section III. RIGGING OF ORDINARY CARGO BOOMS

67. GENERAL

Before a ship can be worked, the booms must be raised or topped and properly spotted. Each man in the hatch section should understand the procedure employed in raising booms, spotting booms in the proper working position, and lowering booms.

68. PROCEDURE FOR TOPPING BOOMS WITH MULTIPLE TOPPING LIFTS AND BOOMS IN CRADLES

The procedure for topping booms with multiple topping lifts and booms in cradles is as follows:

a. Assign men to winches, guys, runners, topping lift, and cathead.

b. Warm up winches.

c. Lay out guys and proper fittings. Proper leads for guys and preventers are pictured in figure 26.

d. Lay out topping lift wire or bull line along the deck or over the rail. Take five or six turns with topping lift wire, or bull line, around the cathead in the opposite direction to the runner (underneath the cathead). Assign men to clear the topping lift wire, and attend the cathead.

e. Assign one man to overhaul the runner as the boom is topped.

f. Raise the boom to desired height by depressing the control lever of the winch and taking in the wire wound around the cathead.

g. Secure topping lift as follows:

(1) Apply stopper chain to topping lift wire, using stopper hitch and two half hitches with remainder of the chain wound around the wire so as to bind the half hitch.

(2) Remove the turns from the cathead and belay the topping lift wire on cleats, using a minimum of three round turns and three figure 8's finished off with mousing, as shown in figure 32.

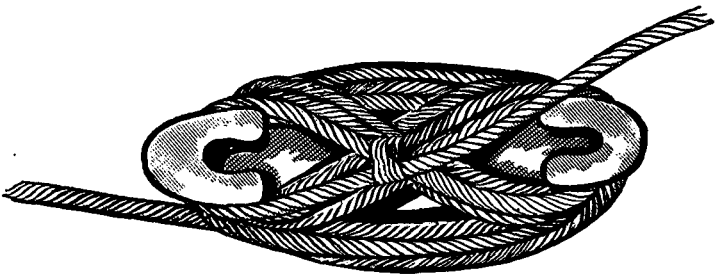


Figure 32. Topping lift on cleat.

(3) Remove the stopper chain.

h. Booms are now raised to proper height.

i. Swing booms to working position by hauling (pulling) on the guys, and spot according to type of rigging desired.

j. Equalize guys and preventers.

(1) Secure the outboard guys and the inboard guys as tightly as possible.

(2) Place a strain on the outboard guys and preventers by lifting a draft equally between the two booms until the angle formed by the cargo runners is 120°.

(3) Equalize the outboard guys and preventers by slacking off the guy tackles slightly.

(4) As this is being done, take in all of the slack in the inboard midship guys.

(5) It is good practice when originally spotting the booms to swing them slightly wider (farther apart) than desired. When the guys and preventers are equalized the booms will swing inboard to the desired position.

69. PROCEDURE FOR TOPPING BOOMS WITH SINGLE TOPPING LIFT AND BOOMS IN CRADLES

a. The procedure for topping booms with a single topping lift is identical to the procedure shown in paragraph 68 with the exception of the procedure for securing the topping lift.

(1) The single topping lift is secured by shackling the bull chain to a pad-eye on deck, as shown in figure 33.

(2) Slack off the bull line until chain supports weight of boom.

(3) Remove the bull line from the cathead and secure to the topping lift cleat with a minimum of three round turns and three figure 8's with the mousing.

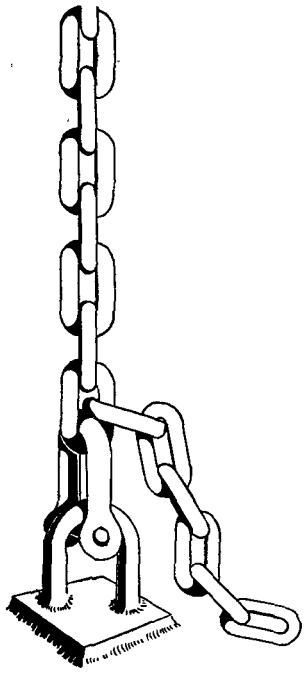


Figure 33. Bull chain secured.

b. There are several alternate methods of raising booms.

(1) One method is by means of the cargo runner which is led from the head block of the boom through a snatch block at the base of the boom, then shackled to one of the top links of the bull chain. By taking in on the runner, the boom is raised; by slacking off, the boom is lowered. A disadvantage of this method is that it requires sending a man aloft to shackle the runner to the upper links of the bull chain.

(2) A particularly dangerous method is to top both booms of the hatch at the same time, using only one topping lift. In this method, the hatch boom is topped in the usual manner, and the outboard boom is carried aloft on the midship guy.

c. Often on ships rigged with the single topping lift, the hatch boom does not normally top sufficiently high to work the extreme ends of the hatch. This condition can be overcome by:

(1) Leading tackles from the topping lift to the ship's rig and heaving them up by the cathead of the winch.

(2) Securing the tackle to wire topping lift by an ordinary chain stopper or by a shackle secured with a wooden wedge and sufficient mousing.

d. In spotting booms for cargo operations, care should be taken that the booms are not raised to an extreme vertical angle which may cause them to topple over backward.

70. PROPERLY GUYING BOOMS

a. The importance of properly guying booms with respect to the angles of stress cannot be overemphasized, particularly when using married falls, since the carrying away of guys because of overstress has resulted in the loss of life, cargo, and time.

b. Figure 29 shows the stress on cargo falls at various angles. As the load on the cargo falls increases, the stress on the guys also increases, according to the angle of the guys. The greater the list of the vessel, the greater the strain on the guys. Therefore, the use of preventer guys whenever possible is strongly urged.

c. The best setting for the midship or hatch boom guys is on the bulwarks even with the heel of the boom, while the outboard guys are secured on the inboard bulwarks, if possible, at an angle of less than 45° from the vertical.

d. Figures 34, 35, and 36 show the correct way to guy a boom on which the cargo fall is doubled up to permit the hoisting of an awkward case or a lift that is too heavy for the married falls method.

e. Figure 34 shows the guy setting, using the midship guy in swinging the draft on the doubled-up inboard boom, over the side. The dotted line shows the wrong setting; the solid line, the right setting. In the latter case, if the midship boom were swung too far outboard, the angle of the guy would be reduced horizontally and vertically, resulting in an increased strain on the outboard guy.

f. Figure 35 shows the vertical angle of the guys. Obviously, a direct lead to the bulwarks from the head of the midship boom would place a great strain on the boom and upon the gear.

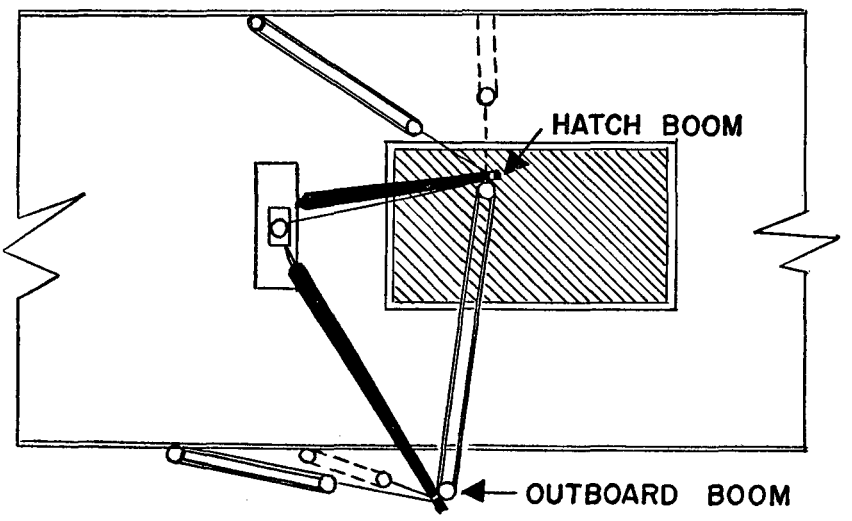


Figure 34. Properly guying booms.

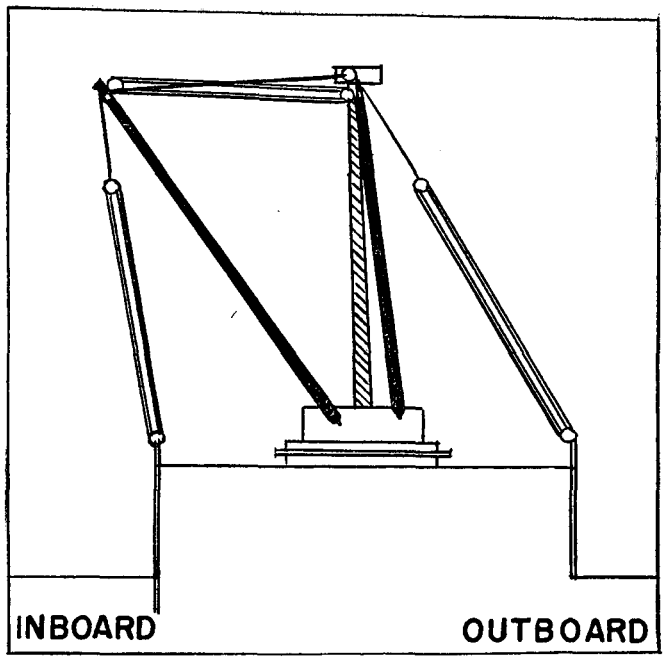


Figure 35. Vertical angle of guys.

g. Figure 36 shows the conventional boom guying, each boom having two guys. The dotted line shows the dangerous angle which would result if the guy were wrongly moved toward instead of away from the heel line position. From the side of the ship, this line shows the vertical angle of the guys on the inboard boom when the boom is swung out with the draft on doubled-up falls.

71. GUYING HEAVY-LIFT BOOM

a. The given capacity of a boom is the safe load it will lift, provided it is properly rigged, guyed, and operated and preventers are properly placed.

b. When using the heavy-lift or jumbo boom aboard ship, it is particularly important that care be taken in the rigging, placing, and tending of guys to prevent undue strain on both boom and guys. It is usually advisable to use the anchor windlass for the forward jumbo boom, and the mooring, or warping, winch for the after jumbo boom, leading one guy over the top of one gypsy head and the other guy underneath the other gypsy head, so that while one guy is pulling, the other is slacking off. The guys should be tended by experienced men, and the rotation of the winch or windlass clearly understood by all so that the proper signals may be given and interpreted to enable a correct, slow, and smooth operation with a minimum of both strain and slack on the following or slacking guy.

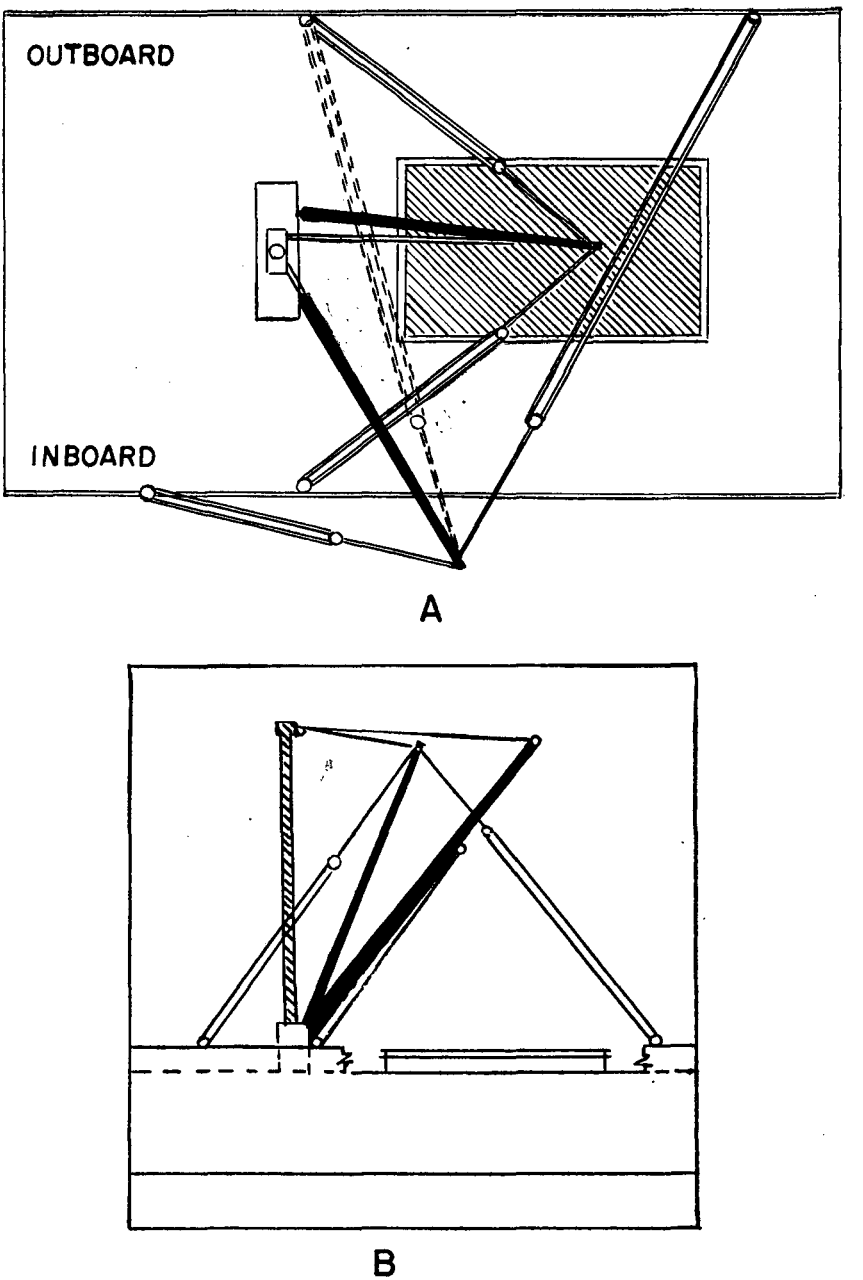


Figure 36. Conventional boom guying.

c. The strain on the guys and the boom increases as the lead on the guys approaches the vertical and as the horizontal angle between the guys and the boom decreases. To place the guys properly, particularly if the ship is listing or likely to list and the boom has to be swung with or against the list, the guy with the greatest strain should be allowed the most favorable angle between the guy and boom (fig. 37).

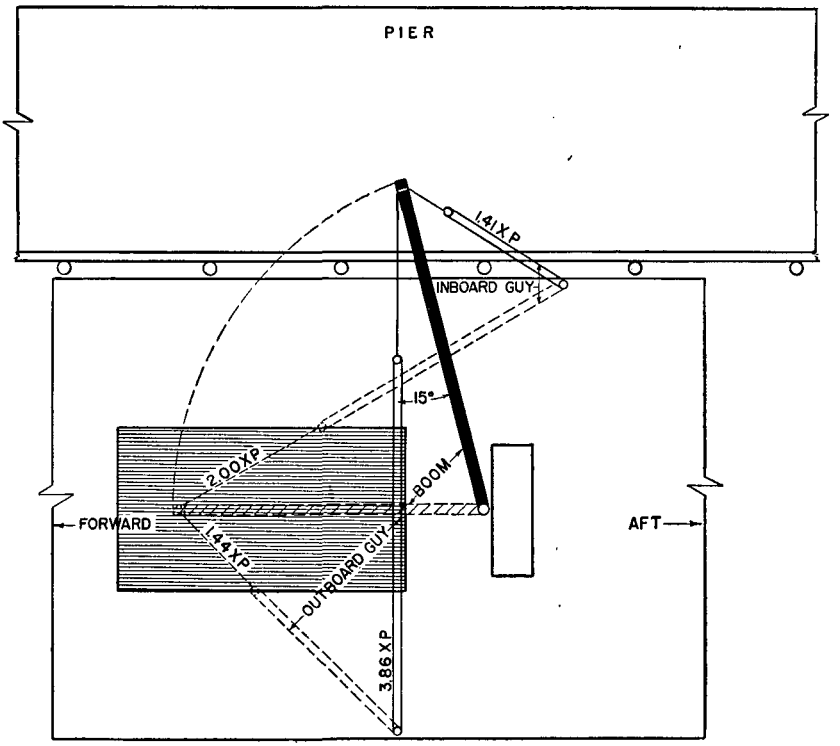


Figure 37. Proper guying for jumbo boom.

d. Figures 37 and 38 show the horizontal strains involved when placing the guys on a heavy-lift boom for loading from or discharging to a pier. The calculations shown in these figures are based on a horizontal plane only.

e. In figures 37 and 38, assume that the ship is being unloaded and is listing or likely to list toward the pier. The outboard guy has been so placed that the horizontal angle between the guy and boom is 15° in figure 36 and 5° in figure 37. Assume that a 3,000-pound pull, indicated by the letter "P," is placed on the inboard guy while the brakes are applied on the outboard winch. In figure 37 the strain would be approximately 4,230 pounds on the inboard guy and approximately 11,580 pounds on the outboard guy. In figure 38 the inboard guy would have the same strain as in figure 37, but the outboard guy

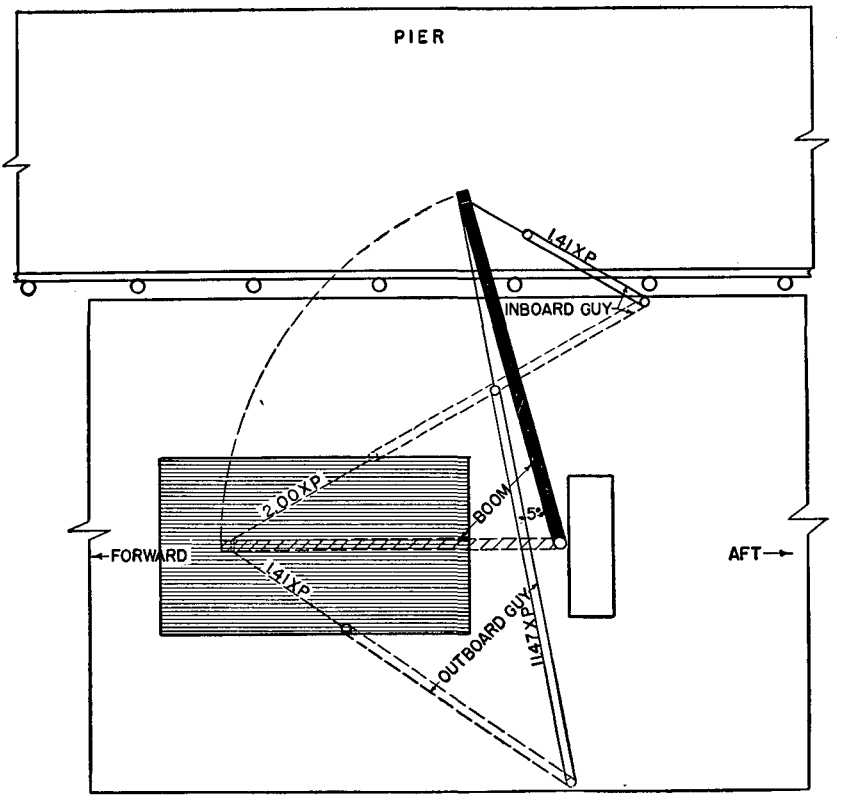


Figure 38. Incorrect guying for jumbo boom.

would have a strain of approximately 34,500 pounds. Thus, it is shown that by decreasing the horizontal angle between the outboard guy and the boom by 10°, the strain is increased approximately 3 times. Practically the same conditions are encountered when loading from pier to ship. If the outboard guy (fig. 37) were shifted forward an appreciable distance, it would be at too steep an angle when spotting the boom over the hatch, particularly if the boom had to be raised to permit loading or unloading in the after part of the hatch. If the vessel is not likely to list, the angle between the inboard guy and the boom could be increased and the operation improved by shifting the guy further aft.

72. EQUALIZING GUYS AND PREVENTERS

a. Guys and preventers must be firmly set and equalized. An important check point for deck men is to watch the slack in inboard and midship guys. When handling heavy drafts by the yard and stay method, these guys may become slack and cause the booms to slap about.

b. The preventer should not be regarded as a useless piece of gear. If the preventer and the outside guys have been equalized, the preventer absorbs half the strain exerted on the outboard guys, and this added protection is there when needed.

c. The preventer should not be limited and allowed to hang loose while the cargo is being worked. Too much strain may cause the outboard guy to break.

73. PROCEDURE OF LOWERING BOOMS WITH MULTIPLE TOPPING LIFTS

a. Similar to the procedure for raising booms (par. 68) is the procedure for lowering booms:

(1) Assign men to winches, guys, runners, topping lift, and cathead.

(2) Apply stopper chain to topping lift wire, using stopper hitch and two half hitches finished off with several turns around the wire.

(3) Remove the three or more figure 8's, and carefully surge the topping lift wire until the stopper chain supports the weight of the boom.

(4) Transfer the wire from the cleat to the cathead.

(5) Take up on the winch until the strain is transferred from the stopper chain to the cathead.

(6) Remove the stopper chain.

(7) The boom may then be lowered by depressing the control handle of the winch.

b. While booms are being lowered, men assigned to tend guys take in on the guy tackles, and the men assigned to tend the runner overhaul it to prevent turns from piling up on the drum of the winch.

c. Booms are landed in cradles and secured upon completion of the operation.

d. When booms are down, all gear is secured.

(1) Runners are rewound smoothly on the drum of the winch, and the cargo hook is secured to a ring or cleat with a slight strain.

(2) Guys are secured to the heel block, or fittings on the mast table, and pulled taut.

(3) The hauling parts of the guys are coiled over the guy tackles and tied off.

(4) Topping lift wires or bull lines are secured to cleats with the remainder coiled on the deck or hung on a cleat.

(5) Bull chains are shackled to pad-eyes on deck.

74. PROCEDURE FOR LOWERING BOOMS WITH SINGLE TOPPING LIFT

The procedure for lowering booms with a single topping lift is identical to the procedure outlined in paragraph 69, with the exception of the removal of topping lift wire.

a. Remove the bull line from cleats, and apply directly or through a snatch block on the deck to the cathead.

b. Raise the boom slightly to place some slack in the bull chain, and remove the shackle fastening the bull chain to the deck.

c. The boom may now be lowered by depressing the control handle of the winch.

75. SAFETY PRECAUTIONS

Raising and lowering booms are not particularly dangerous operations. A few of the situations in which carelessness can produce accidents are:

a. Men standing under booms during the raising and lowering.

b. Disorderly or dirty deck where men are working.

c. Failure to properly secure the stopper chain.

d. Improper securing of topping lift.

e. Improper shackling of bull chain.

f. Allowing slack turns on the cathead to accumulate and be in danger of falling off.

g. Failure of men to wear gloves when handling wire rope.

Section IV. OPERATION OF CARGO BOOMS, SINGLE RIGGED

76. GENERAL

Fast and efficient handling of light drafts of cargo weighing 1 to 1½ tons is accomplished with the cargo runner single rigged. Doubling up runners, swinging booms, or doubling up booms are necessary to work heavy lifts on ordinary rigging. These rigs are slower than single-rig gear.

77. OUTBOARD AND AMIDSHIPS RIG WITH MARRIED FALLS

a. Methods. The union or married-falls system is the most common system for loading or unloading cargo. This is also referred to as the yard and stay method.

b. Rigging.

(1) One boom is spotted over the center of the hatch (referred to the amidship or hatch boom), and the other is spotted over the side of the vessel (referred to as the outboard or Burton boom).

(2) The ends of the cargo falls are shackled or married to a single cargo hook.

c. Operation.

(1) In discharging operations, the cargo is attached to a cargo hook in the center of the hatch.

(2) The draft is lifted directly up by the cargo falls of the boom spotted over the hatch. At the same time, the slack in the other fall is taken up.

(3) As the draft reaches the desired height above the coaming, the lifting cargo fall is slacked off, while the fall on the outboard winch continues the lifting operation. This action carries the draft of cargo over the side of the vessel. The outboard winch then lowers the draft to the pier.

(4) In loading cargo, the operation is reversed.

78. WING AND WING

a. The wing and wing method, also called the "west coast" rig, is the modified form of the yard and stay, married falls method generally used to handle cargo.

b. This operation differs from the yard and stay method only in the spotting of the hatch boom. Instead of locating the hatch boom over the center of the hatch, the boom is spotted slightly beyond the center of the hatch.

c. The particular advantage of the "west coast" rig is the ease with which the draft can be landed on either side of the hold or 'tween deck, close to the point of stowage. Skillful winch operation is required, because the draft is lowered or raised from the hold supported equally by both runners. Normally, only one winch operator is used in this type operation.

79. SINGLE SWINGING BOOM

(Fig. 39)

a. In the event a ship is rigged with only one cargo boom to a hatch or that one cargo boom is broken or otherwise not usable, a single swinging boom may be used. For this type of operation, one winch is used to top and lower the boom.

(1) The topping lift is fastened to the winch drum after the useless cargo runner is stripped off.

(2) The second winch is used to raise and lower the draft with the regular runner.

(3) In order to swing the boom from side to side, two guys are used, both guys being fast at the head of the boom leading to the pad-eye, ring on deck, or the rail. Power to move the boom from side to side can be furnished by using another set of winches, one for each guy.

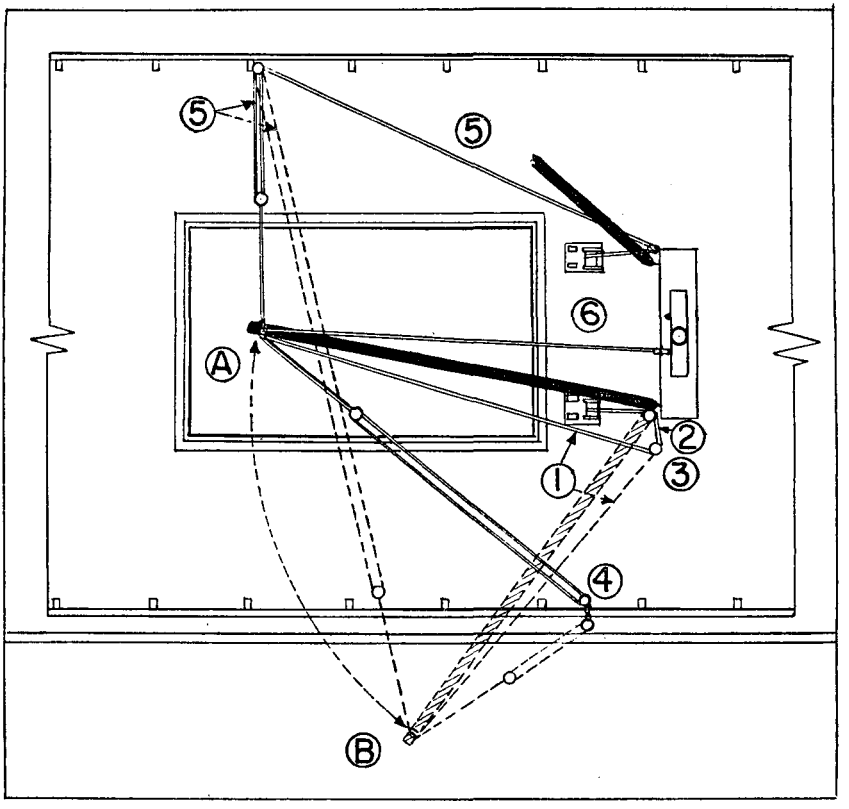


Figure 39. Single swinging boom.

b. Four sources of power are needed to operate a single swinging boom:

(1) One source raises and lowers the boom.
(2) A second source raises and lowers the cargo.
(3) A third source swings the boom to the right.
(4) A fourth source swings the boom to the left.

c. The capacity of this type of rigging is limited to the safe working load of the ordinary cargo boom.

80. HOUSE FALL

a. The house fall is illustrated in figure 40 and operates as follows:

(1) The hatch boom runner is married with a runner reeved through a block attached to a steel structure atop the shed on the pier. This runner replaces the runner of the outboard boom and has the advantage of permitting the drafts to be handled at a considerable distance from the ship's side.
(2) The house fall or runner can be operated with one of the ship's winches, as illustrated, or with a winch on the pier.

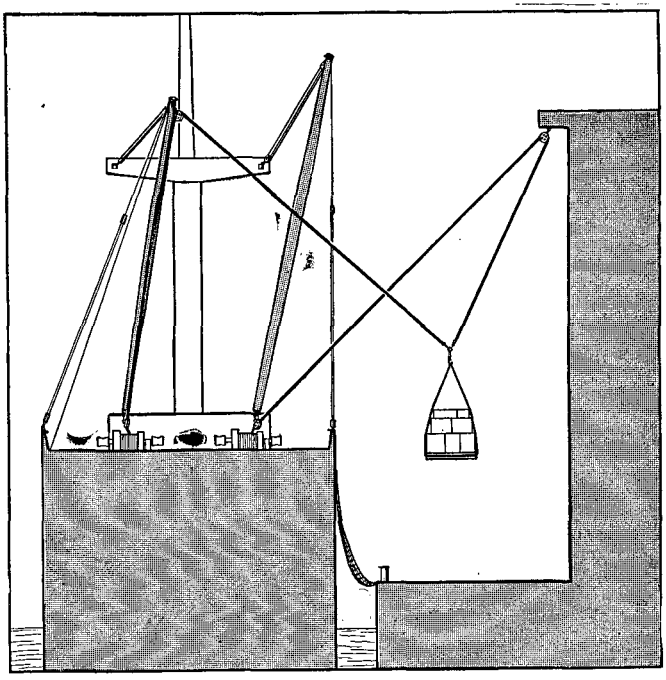


Figure 40. House fall.

b. It is often possible to work one boom at a hatch married with a house fall discharging to shoreside, while the other boom is worked as a single swinging boom discharging offshore to a lighter or barge. In this manner, two gangs may be worked at the larger hatch, reducing the time required to discharge a ship.

81. PICK AND STRIKE

a. The method of rigging known as pick and strike involves the use of two booms with runners operated separately. The outboard boom is spotted over the pier; the hatch boom is located over the hatch.

b. In discharging, the draft is lifted from the hold to the deck of the ship by the hatch boom. The natural swing of the draft may be utilized to land the draft on deck alongside the hatch coaming. If there is insufficient natural swing, the signalman should reach out and swing the draft through an arc, signaling for it to be lowered when it is over the deck. Occasionally, if the ship is listing slightly, the hatch boom may be swung 4 or 5 feet to facilitate landing the draft on deck. As soon as it is landed, the hatch runner is unhooked and returned to the hold for the next draft. The outboard runner is hooked to the draft, and it is quickly picked in order to clear the rail and lowered to the pier. To avoid striking the draft against the rail, a skid is sometimes constructed from the deck to the rail.

c. In loading, procedure used in discharging is reversed.

d. Operation of the pick and strike method requires two signalmen, one tending each runner. Fragile cargo should never be handled in this manner.

82. SPLIT FALLS

a. The split falls method of handling cargo combines the pick and strike and married falls operations.

(1) The outboard boom is spotted over the apron of the pier.
(2) The hatch boom is swung within 4 to 5 feet of the inshore hatch coaming.
(3) Both runners are shackled to rope pendants of approximately 3½ inches in circumference and 15 feet in length, equipped with special light hooks.

b. In discharging, the draft is picked up in a position just below the hatch runner.

(1) The signalman swings the rope pendant to the outboard runner around the sling supporting the draft forming a half hitch.
(2) The outboard hook is caught in the bight of the sling.
(3) The draft is then raised above the coaming and moved athwartship to the ship's rail by the joint action of both winches.
(4) Just before the draft is lowered to the pier, a signalman releases the hatch runner which returns to the hold.

c. In loading, the procedure used in discharging is reversed.

d. A split falls operation is adapted to fit such cargo as bagged goods and strong durable cases. Drums can be handled if the drum hooks are attached to a large drifting ring or shackle able to accommodate the hooks of both runners. In this operation the outboard runner need not be thrown around a sling as described, but can be placed directly in the lifting ring.

e. A trained hatch section can handle an amazing amount of cargo by the use of the split falls, because both hooks are always moving.

83. SKID METHOD

a. One of the simplest methods of using a ship's gear is the skid or whip system used in handling cotton.

(1) Only one boom is required and is spotted directly over the hatch opening.
(2) An inclined skid or board construction is placed in position leading from the pier to the ship's rail. The draft is slung at the foot of this skid, and the cargo hook is attached to sling.

(3) The cargo is dragged up the incline skid and over the ship's rail. The draft swings over the hatch opening by its own weight and is quickly lowered into the hold.

(4) The draft has a tendency to swing wildly, but this can be controlled by a tag line attached to the hook. This line is also handy for returning the hook for the next draft.

b. At large hatches, it is possible to work both booms by the skid system, one spotted at one end of the hatch, the other at the far end of the hatch. This is called double whipping.

c. The skid system is applicable only to loading operations and may be used only for certain types of cargo.

84. SAFETY PRECAUTIONS

Safety precautions for the operation of cargo booms are as follows:

a. Unnecessary slack in the guys should never be permitted to develop, thus permitting the bloom to slap around.

b. Guys must never be tightened to a point where they may be parted by the strain. When a boom is taut, the guys must be slacked off slightly.

c. When the boom is lowered, the guys should be taken in.

d. During normal cargo operations, the slack should be kept out of the guys and preventers in order to keep the strain equalized—that is, not all on one boom.

Section V. RIGGING OF ORDINARY CARGO BOOMS FOR HEAVY LIFTS

85. GENERAL

a. Because of the large amount of heavy equipment shipped by the Army, a knowledge of heavy-lift rigging is essential to the military stevedore. The methods of handling ordinary cargo drafts of bulk and weight suited to single gear are quickly learned. However, the skill and judgment required in handling heavier commodities is not as easily acquired.

b. Most modern American ships are equipped with booms having a safe working load (SWL) of 5 tons. The capacity of most cargo booms is usually marked on the boom heel. If the SWL is not marked on the boom, the ship's officers should be consulted for the data.

c. Winches vary in capacity from 4 to 7 tons. The exact figure can be ascertained from the manufacturer's name-plate on the machine or from a ship's officer.

d. Wire rope of five-eighths of an inch diameter is most commonly used as runners; however, some vessels are equipped with three-quarter-inch and seven-eighths of an inch runners. The SWL

of five-eighths of an inch wire varies from 2½ to 3 tons, depending upon the type of wire, method of construction, and the intended use. Thus, it is apparent that some special provision must be made if lifts of over 3 tons are to be safely handled. For a 3-ton lift, five-eighths of an inch wire is usually doubled up.

e. There are many methods of rigging cargo booms for heavy lifts. Practically all of these methods involve doubling up the cargo runner. Doubling up accomplishes a twofold purpose—it not only serves to double the load to be lifted by the runners, but also decreases the

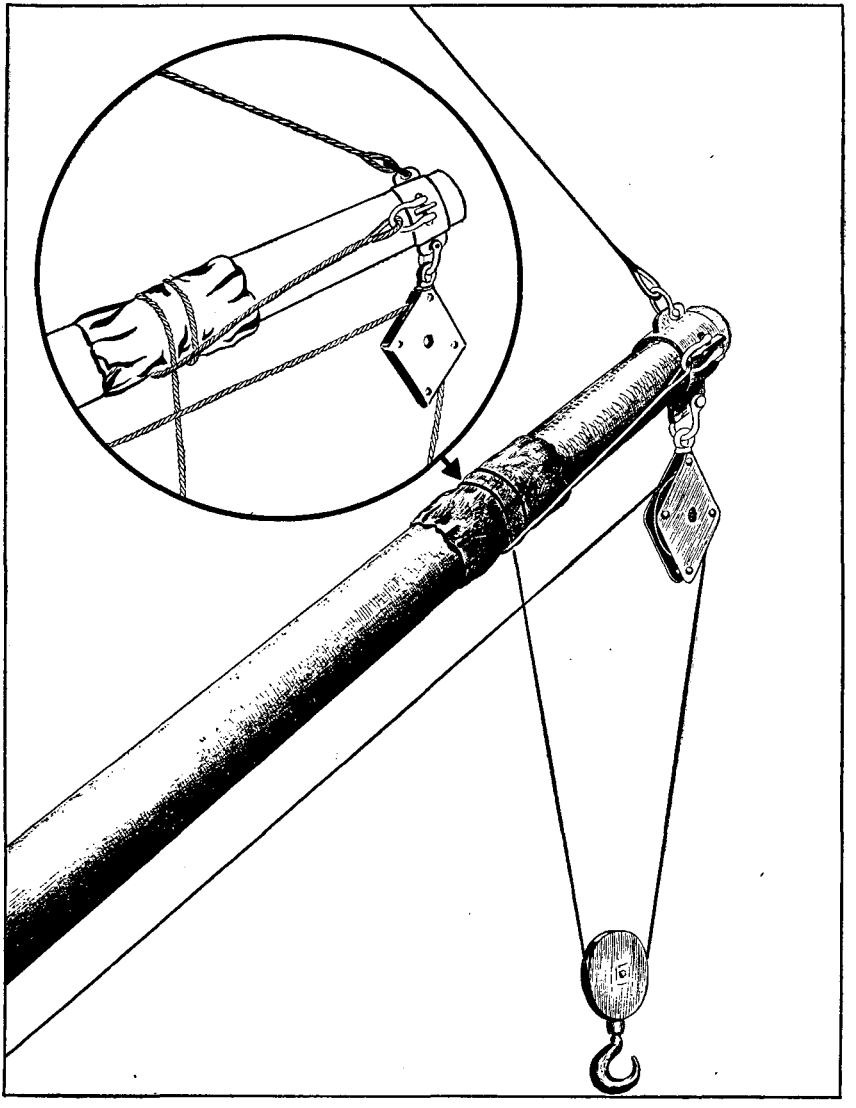


Figure 41. Doubling up cargo runner.

strain of each winch by one-half. Therefore, although it is not necessary to double up a seven-eighths of an inch runner to lift a 5-ton load safely, it may be necessary to double up so that the winch will pull the load (fig. 41).

86. OUTBOARD AND AMIDSHIPS, DOUBLE PURCHASE

a. To handle lifts beyond the capacity of the cargo runners, cargo booms are often rigged with a double purchase on each boom with the falls married for regular yard and stay operation (fig. 42).

(1) The end of the runner is reeved through a 12-inch block and secured to the boom about 4 feet back from the head with two round turns.

(2) The eye-splice in the end of the runner is shackled to the link band at the head of the boom.

(3) The turns around the boom must be started from inside to prevent chafing against a runner as it leads from the heel block to the head block.

b. After both booms have been doubled up in this manner, two falls are married to a cargo hook. The booms are topped, spotted, and worked as in a regular yard and stay operation. In working this rig, guys and preventers must be in excellent condition and equalized as nearly as possible.

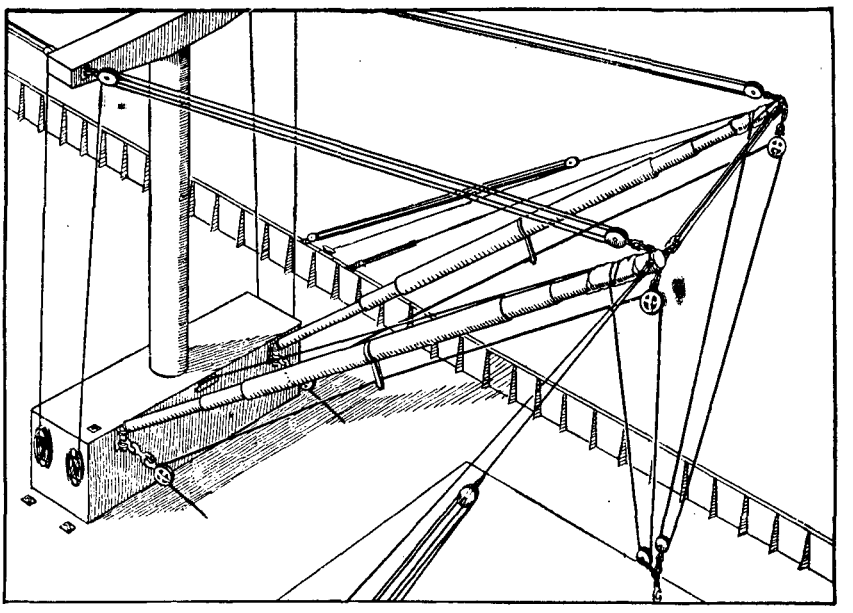


Figure 42. Outboard and amidships rigging with double purchase.

c. The chief advantages of this method of rigging are:

(1) Lifts as heavy as the SWL of the cargo boom can be handled at nearly the same rate as ordinary 1- or 1½-ton drafts.

(2) Light filler cargo encountered can be handled without time lost in stopping the operation to rig the jumbo boom.

87. SINGLE SWINGING BOOM WITH DOUBLE PURCHASE

a. A single swinging boom with double purchase is considered one of the best methods of rigging for handling loads beyond the capacity of a single-runner to the capacity of a single boom. It is quickly and easily rigged and has the same advantage of flexibility (fig. 43). Drafts may be placed at any points in the square of the hatch or on deck.

b. The rigging procedure is as follows:

(1) Commence with hatch boom topped, swung out of the way, and secured close to the shrouds. Outboard boom should be lowered in boom rest.

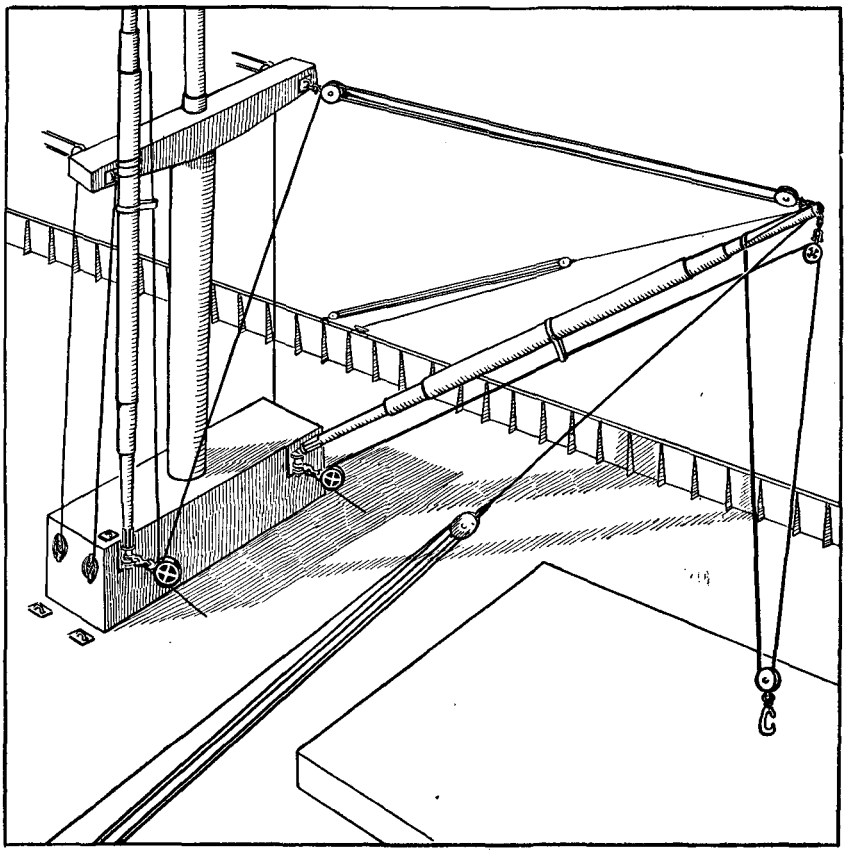


Figure 43. Single swinging boom with double purchase.

(2) Strip runner of hatch boom from drum of winch and fairlead topping lift of outboard boom through the heel block, and secure to the drum of the winch.
(3) Ascertain that outboard boom is equipped with a long runner to permit the doubling up of the falls.
(4) Double up falls as illustrated in figure 41, using a 12-inch block.
(5) Remove preventer from outboard boom, and lead guys to proper fittings.
(6) Top boom using second winch, swinging boom to the desired position by hauling guy tackles.
(7) To swing the boom for loading or discharging cargo, men should be assigned to all the guy tackles.

c. As an alternate, the hauling part of the guys may be lead through a system of snatch blocks to winches at an adjacent hatch, anchor windless, or warping winch. Rigged in this manner, the ordinary cargo boom becomes a small version of a jumbo boom.

d. An expedient which will greatly increase the speed with which the swinging boom may be operated is leading the runner several feet off-center toward the direction in which the draft is to be moved.

e. Some authorities claim that the single swinging boom rigged for heavy lift or "live boom" is slow and requires an excessive number of men in the deck crew. Offsetting these disadvantages is the extreme flexibility of this type of rigging which will save valuable minutes in placing heavy lifts at any desired point.

88. TWO SWINGING BOOMS, BLOCK AND BIGHT

a. The method illustrated in figure 44 is used only when the lift exceeds are SWL of a single boom, since it divides the weight of a draft between both booms. This is definitely an expeditious type of rigging and should be used only when other mediums of handling cargo are not available.

b. Rigging and operating procedures are as follows:
(1) Check runners as to length. If they are not long enough, reeve in a longer runner on at least one boom, preferably the outboard.
(2) Reeve long runner through the 12-inch block, and shackle eyes of the hatch and outboard runner together.
(3) Hoist hatch runner aloft until shackle joining the two falls is about 1 foot from the head block. Take weight on the outboard runner until doubling up block hangs in bight clear of deck.
(4) Remove preventers, and have the guys tended by capable men, swinging both booms over the side of the ship above the load.

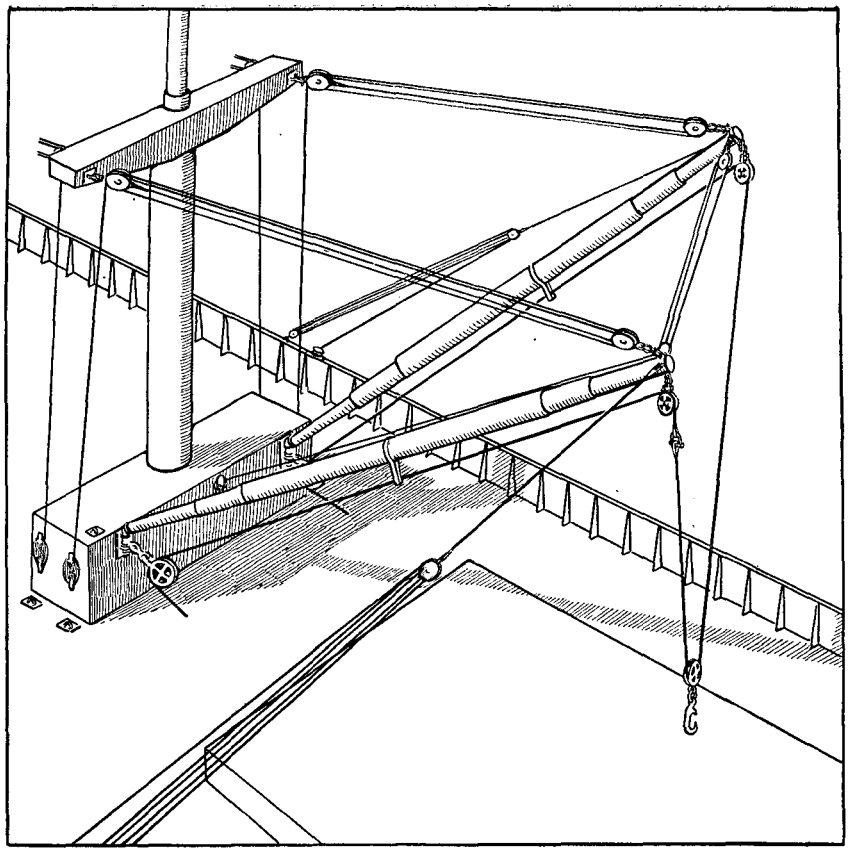


Figure 44. Block in bight.

(5) Hoist heavy lift with power of outboard winch only until clear of rail.

(6) Swing both booms carrying load inboard—a difficult operation which should be accomplished slowly. Often it is necessary to apply power of adjacent winch to swing both booms in this manner.

(7) When it is over the desired landing spot, lower load by operation of outboard winch only.

c. The difference in the reach of the hatch boom and the outboard boom—since one is stopped farther away from the point of lifting than the other—makes this method of rigging cumbersome and difficult to operate. The load has a tendency to strike and drag up the side of the ship; but this can normally be corrected by working with the hatch boom 4 or 5 feet lower than the outboard boom.

d. Capacity of this type of rigging is equal to the SWL of two parts of the runner used, but must not exceed the combined SWL of the booms being used.

89. TWO SWINGING BOOMS WITH EQUALIZER BAR

a. A load greater than the capacity of a single boom may be handled by using two booms worked together as a single swinging boom (fig. 45). The runners of the two booms should be fastened to opposite ends of a lifting bar. If preferred, the runners may be attached direct to slings at either end of the case, but this method is not recommended.

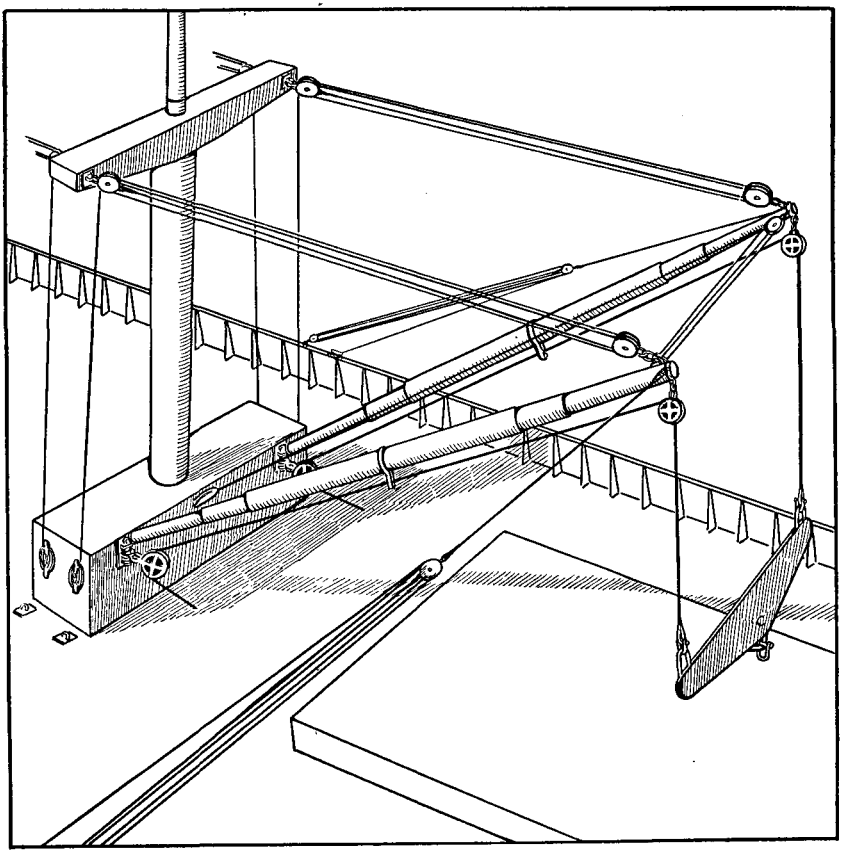


Figure 45. Two swinging booms with equalizer bar.

b. A load is hoisted evenly by both runners. The lifting bar serves to equalize the winch operation on the two runners. When the draft has cleared the hatch coaming, the two booms are swung in unison over the side by use of the guy tackles, and the guy tackles and the guy are lowered as required. It may be necessary to land the draft on the ship's deck and change the direction of the booms.

c. This type of rigging should be used only in an emergency and when other equipment is not available.

90. TWO SWINGING BOOMS, DOUBLED UP

With cargo runners of 5/8-inch line having an SWL of 3 tons, the rigs described in paragraphs 108 and 109 would be able to pick up only 6 tons safely, since the cargo runner would be the limiting factor. By doubling up the runners of each swinging boom as described in the yard and stay method (par. 97), and shackling the running blocks into a lifting bar, a load equal to the combined SWL's can be handled.

91. BLOCK AND BIGHT METHOD OF RIGGING ON DOUBLE-RIGGED HATCH

a. Many present day ships, including the Victory ships and vessels of the "C" type, are fitted with double-rigged hatches equipped with two pairs of ordinary cargo booms. Handling heavy lifts at a hatch rigged in this manner is facilitated by rigging all four booms as illustrated in figure 46.

b. The procedure is as follows:

(1) Reeve runner of forward hatch boom through 12-inch block, and shackle eye to eye with runner of after hatch boom.

(2) Reeve runner of forward boom through 12-inch block, and shackle eye to eye with runner of after outboard boom.

(3) Hoist the shackles joining the two sets of runners aloft to within a few feet of the head blocks of the after booms.

(4) Marry the two 12-inch blocks for regular yard and stay operation.

(5) Ascertain that booms are spotted properly and guys and preventers equalized.

c. Heavy lifts not exceeding the SWL of two parts of the cargo runner may now be loaded or discharged by using married falls or the usual yard and stay method. This type of rigging has the decided advantage of being quickly rigged without the necessity of lowering booms. Moreover, only two winches are required, and the gear may be readily "singled up" for ordinary light drafts.

92. FOUR BOOMS DOUBLED UP ON DOUBLE-RIGGED HATCH

a. At a double-rigged hatch with four 5-ton booms, lifts up to 8 or 9 tons may be handled safely by doubling up all four booms (fig. 47). This method of rigging is as follows:

(1) Double up the runners of all four booms by reeving end of runner through 12-inch block and securing to head of boom as described in paragraph 87.

(2) Marry the doubling up blocks of the two outboard or burton falls by use of a 1-inch wire strap reeved through a 12-inch block.

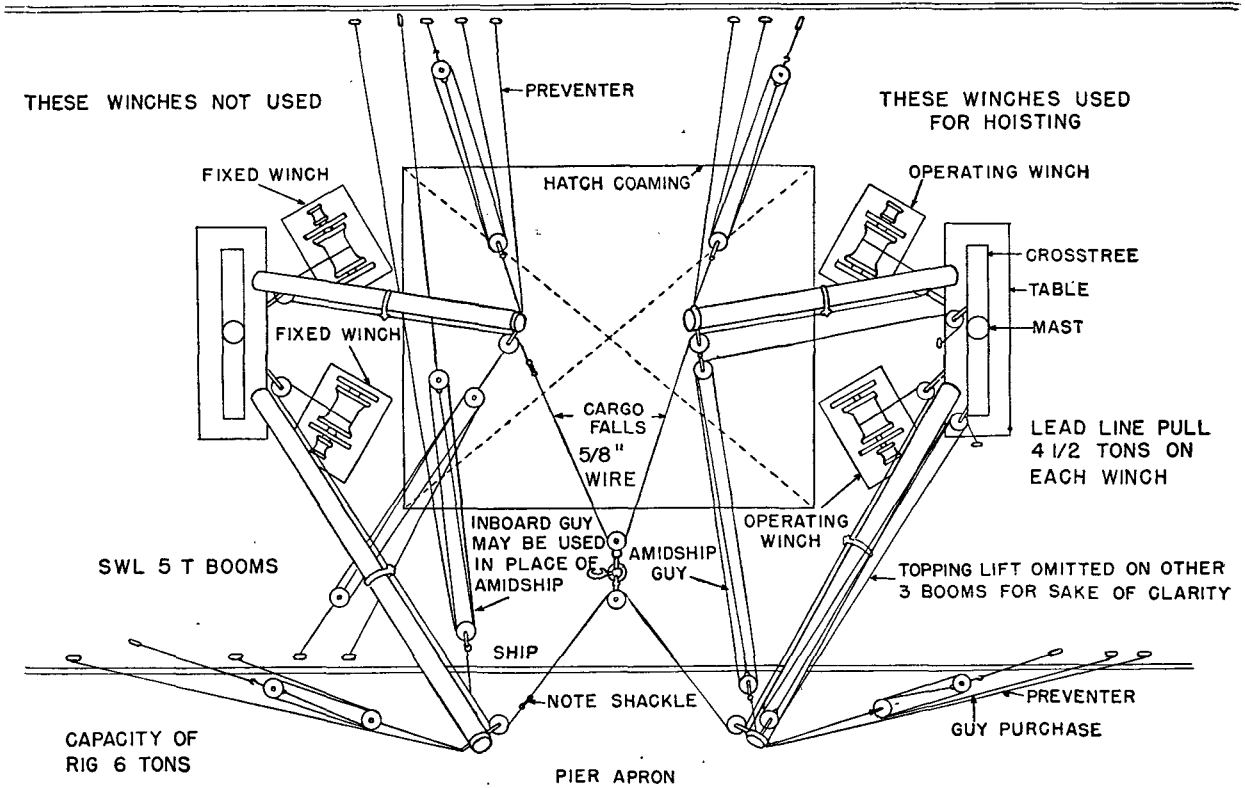


Figure 46. Double-rigged hatch, block in bight.

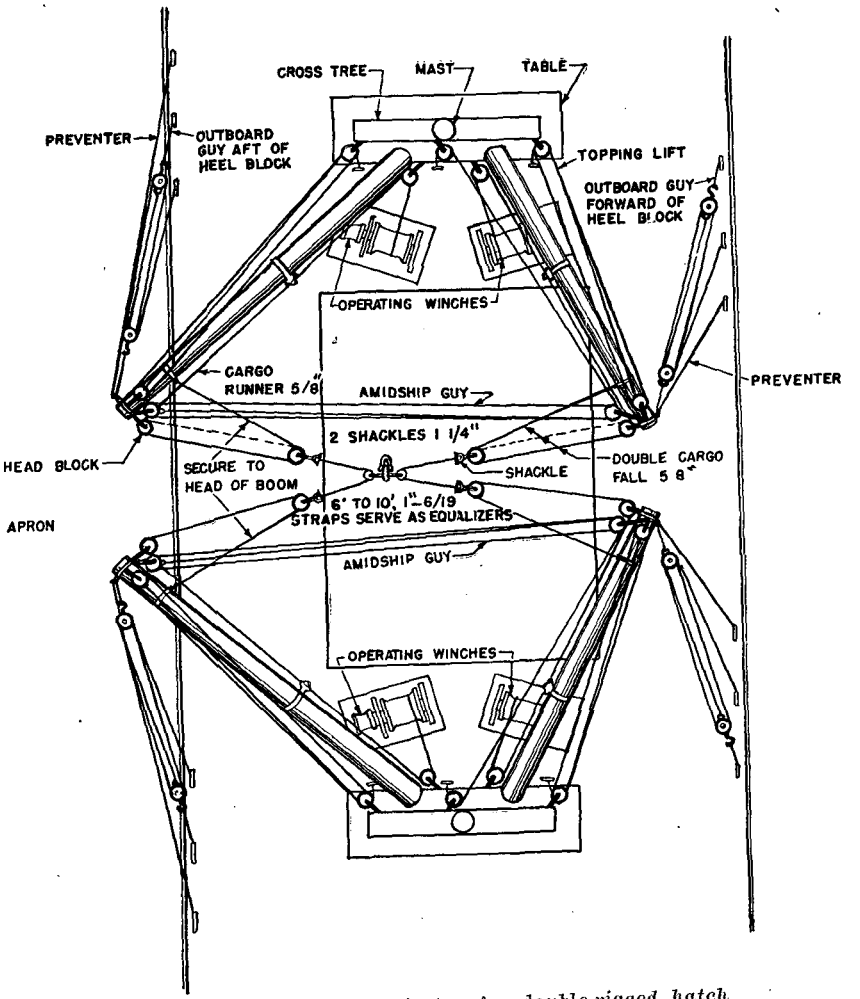


Figure 47. Heavy-lift rigging for double-rigged hatch.

(3) Marry the doubling up blocks of the two hatch or amidship falls by use of a 1-inch wire strap reeved through a 12-inch block.

(4) Shackle or marry these two blocks into the cargo hook or into larger shackles.

(5) Check all guys and preventers carefully to make certain that they are correctly placed and equalized. The two 1-inch wire straps which are reeved through blocks joining the outboard falls and the hatch falls serve as equalizers in case the winchmen are not synchronized in making the lift.

b. If booms are equipped with inboard guys instead of amidship guys, they should be led outboard to further strengthen the normal outboard guys. The weight of the blocks and/or the load will keep

the booms from swinging outboard. The lift should be carried close to the deck to avoid a "fiddle string" pull.

Section VI. HEAVY LIFTS

93. GENERAL SAFETY PRECAUTIONS

The operation of cargo booms rigged for heavy lift requires skill, judgment, and the application of common sense. Stevedores must understand that the load should be plumbed directly underneath the boom before it is picked up; they must know the importance of tag lines in checking the swing of heavy drafts; they must be familiar with the safe working load (SWL) of all types of rigging and slings.

94. SURVEY OF RIGGING FOR SAFE AND EFFICIENT OPERATION

In working heavy lifts, all standing and running rigging and deck fittings must be checked frequently to detect unusual wear and chafing.

a. The cargo runner must be firmly secured to the drum of the winch. This can be done by reeving the end of the runner through the hole in the drum of the winch, out through the openings in the side of the drum, and twice around the shaft.

b. The runner may be secured either with a rope yarn or with wire clamps. The latter method is recommended. As an additional precaution, winchmen should never operate with less than three turns around the drum of the winch.

c. If necessary, when working to the lower hold, piers, or lighters, a long runner should be used in order to retain a minimum of three turns on the drum at all times.

d. Shackles, hooks, and gates of snatch blocks used in rigging should be secured with rope or wire. In mousing a shackle, the pin should be tightened, then secured with rope yarn or wire.

(1) In all cases where rigging is aloft, wire should be used for mousing; care should be exercised not to place the mousing where it may be cut by the wire rope as it passes the shackle.

(2) Hooks are moused for two principal reasons—to strengthen the hook, and to prevent the slings from slipping off the hook.

(3) Hooks may be moused with rope yarn, wire, or shackles.

(4) The gates of snatch blocks, unless firmly moused, may open, allowing the wire to jump out.

e. Before any operation, all shackles and blocks should be checked to see that they have been secured as outlined in *a* through *d* above.

95. SAFETY PRECAUTIONS

In making a heavy lift, all men in the hatch must be on the alert for failures in the gear and other possible hazards. Before a heavy

lift is finally hoisted, it should be picked up a few inches and thoroughly inspected. The slings should be checked for adjustments and chafing. If necessary, the draft should be lowered and the sling readjusted or blocked off with dunnage. While the load is suspended off the deck, the rigging (including booms, topping lift and runners, and guy tackles) should be carefully observed for indications of unusual strain. When it has been ascertained that everything is in order, the draft should be hoisted slowly in one continuous load operation. All blocks should be running free with no chafing or blinds in cheeks of the blocks. Much can be determined by listening to the gears as the lift is being made. A faulty block, wire, or rope under strain generally squeaks and groans loudly enough to give warning to the alert man. When operating heavy-lift gear, *stop*, *look* and *listen*.

Section VII. RIGGING OF HEAVY-LIFT OR JUMBO BOOMS

96. PURPOSE

Tanks, landing craft, harbor boats, crash boats, locomotives, and other extremely heavy cargo required by the Army in the field present difficult problems in stevedoring operations. At ports of embarkation in this country, loading a heavy lift is a fairly simple operation. However, the problem does not end at the loading port. At oversea bases, these heavy lifts must be discharged, although shoreside equipment or floating cranes are not always available. Often the ship's gear must be utilized for this purpose. Most modern ships are fitted with jumbo booms of up to 50-ton capacity, generally located at the largest hatch of the vessel (fig. 48). Many of the ships used in task force operations, particularly in securing beachheads, are equipped with heavy-lift gear at practically all hatches for expeditious discharge of such heavy equipment as landing craft, tanks, and bulldozers. All Army stevedores operating in the field will have occasion to operate heavy lifts. For this reason, the method of rigging and the operating procedures for the jumbo boom must be understood.

97. METHODS OF RIGGING

a. Most heavy-lift booms are fully rigged with topping lift, purchase, and guy tackles already secure. In order to leave space on deck for cargo available, the jumbo boom is generally carried in an upright position against the mast (fig. 49).

b. The first step in rigging a jumbo boom is to lead all purchases to power.

(1) Four sources of power are required, as follows:

(*a*) For the cargo fall—to raise and lower the cargo hook.

(*b*) For the topping lift—to raise and lower the boom.

(*c*) For rack of the guys—to swing the boom from the hatch opening to the pier and return.

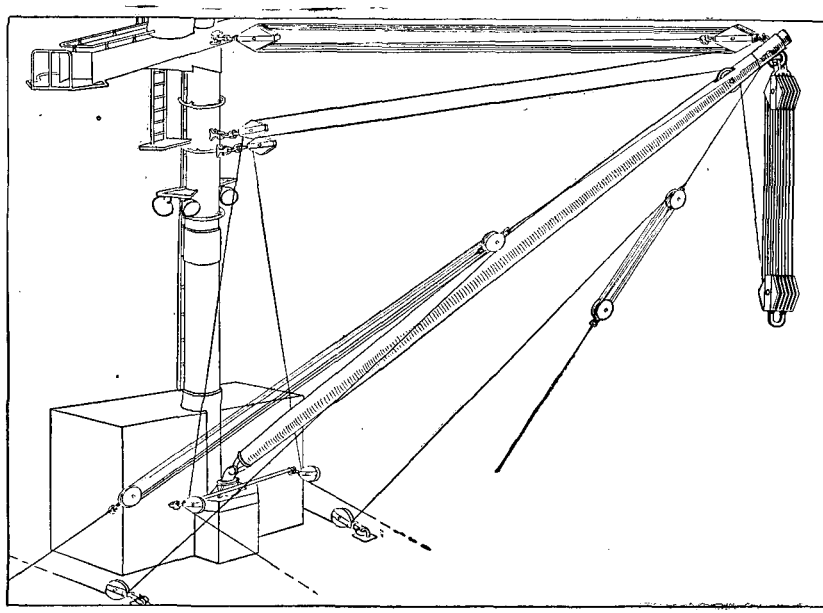


Figure 48. Typical heavy-lift or jumbo boom.

(2) Normally, only two winches are located at a hatch, and two additional sources of power must be utilized. These two additional sources may be supplied by the capstan, the warping winches, or winches at an adjacent hatch.

(3) The four sources of power are utilized as follows:

(*a*) The cargo runner is led through a heel block to one winch at the hatch being worked ((1) (*a*) above).

(*b*) The topping lift is led through another heel block to the second winch also at the hatch being worked ((1) (*b*) above).

(*c*) The two guys are shackled to a pad-eye at the proper place, and the hauling part of the rack is led through a snatch block to the additional sources of power. The snatch block is attached as close as possible to the point where the guy is made fast ((1) (*c*) above).

c. At this point, the jumbo or heavy-lift boom has all purchases led to power and the guys made fast; however, the boom is still held fast to the mast (fig. 49).

d. The next step is to remove the collar or lashing which holds the boom to the mast. This is accomplished as follows:

(1) Take a strain on the topping-lift wire to release the pressure on the collar or lashing. This may not be possible on all vessels.

Figure 49. Jumbo boom secured in upright position.

(2) Use a "breasting up" line.

(*a*) Pass the "breasting up" line around the boom, through a snatch block on the mast, and down to the cathead on the winch.

(*b*) Take a strain on the "breasting up" line, and release the collar or lashing holding the jumbo boom in place.

(*c*) Slack the line slowly until the weight of the boom is placed on the topping lift.

(*d*) Remove the "breasting up" line, and lower the boom into position with the topping lift.

(3) In either of the above methods, men must be sent aloft to release the boom.

e. As the jumbo boom is operated similarly to a single swinging boom, the guys are placed as follows:

(1) The outboard guy is secured directly opposite the head of the boom.

(2) The inboard guy is secured opposite the heel of the boom.

Section VIII. OPERATION OF HEAVY-LIFT OR JUMBO BOOMS

98. PREOPERATION PRECAUTIONS

The following precautions should be taken before operation of the jumbo boom:

a. The ordinary cargo booms of the hatch should be swung clear of the working area. Generally, it is sufficient to swing these booms against the shrouds and secure them with the boom guys. It may be necessary to top the booms extremely high when working deck cargo.

b. All gear should be thoroughly checked to insure that:

(1) All blocks are running free.

(2) None of the lines are chafing.

(3) The turns on the winches lie evenly on the drum.

(4) Snatch blocks are securely measured to prevent opening.

(5) Guy tackles are free of twists and fairlead to sources of power.

(6) The prevention stays are secured and tightened.

c. It should be insured that the signalman and winchman understand the signals for the rack winch. An additional signalman may be necessary to relay signals to the men tending guy lines at the windlass or warping winch. The number of signalmen should be kept at a minimum, however.

d. The lift to be hoisted must be slung carefully and the slings shackled to the lower block on the cargo runner.

e. After a final check to see that everything is secure, the load should be hoisted a few inches and all gear rechecked for indication of understrain.

99. OPERATION

a. All heavy-lift operations must progress slowly and smoothly. Faulty winch operation, sudden stops, or quick starts must be avoided.

b. The load must be carefully hoisted until it clears the hatch coaming.

c. The angle of the boom must be adjusted by taking up or slacking the topping lift.

(1) Every change in the position of a jumbo boom must be accompanied by an adjustment of the guys.

(2) As the boom is raised, the guys must be slacked off; as it is lowered, the guys must be tightened.

d. The boom is swung by taking up on one guy and slacking the other.

(1) One of the greatest difficulties in working a jumbo boom is handling the guys. Special coordination is required between the men tending the guys.

(2) When a boom is swung either inboard or outboard, one guy is the hauling guy and the other is the following guy.

(*a*) Slack must be maintained in the following guy to prevent undue strain on the hauling guy.

(*b*) Too much slack in the following guy will allow the boom to slap around.

(3) As the heavy lift is swung outboard, a tender ship may suddenly develop a considerable list. This places an additional strain on the guy and preventers, as the boom has a natural tendency to swing in the direction of the list. This must be controlled by the following guy.

e. The load is lowered to the pier or hold by slacking the cargo runner.

Section IX. USE AND RIGGING OF HATCH TENTS

100. PURPOSE OF HATCH TENTS

A hatch tent is a large shelter of canvas, suspended from the heads of the booms covering hatch openings. Its purpose is to protect cargo and men, thus permitting operations to continue during inclement weather. While hatch tents are commonly used in a rainy climate, they are also used in a tropical climate to improvise shade during extreme heat. This use is employed especially when discharging refrigerated cargo.

101. TYPES

In order to work during weather conditions unfavorable for such an operation, various types of hatch tents have been used fairly successfully. The two main types are the "west coast" and the "pyramidal" types.

a. The "west coast" type is considered the best all-purpose hatch tent. This type (fig. 50) resembles a shelter tent and affords the hatch greater protection, because it completely covers the hatch since the covering is moved farther away from the hatch coaming. It is rigged to provide a very small slot in the top of the tent to allow the cargo falls flexibility of motion.

b. The "pyramidal" type resembles a pyramidal tent and is suspended from the hatch boom only (fig. 51).

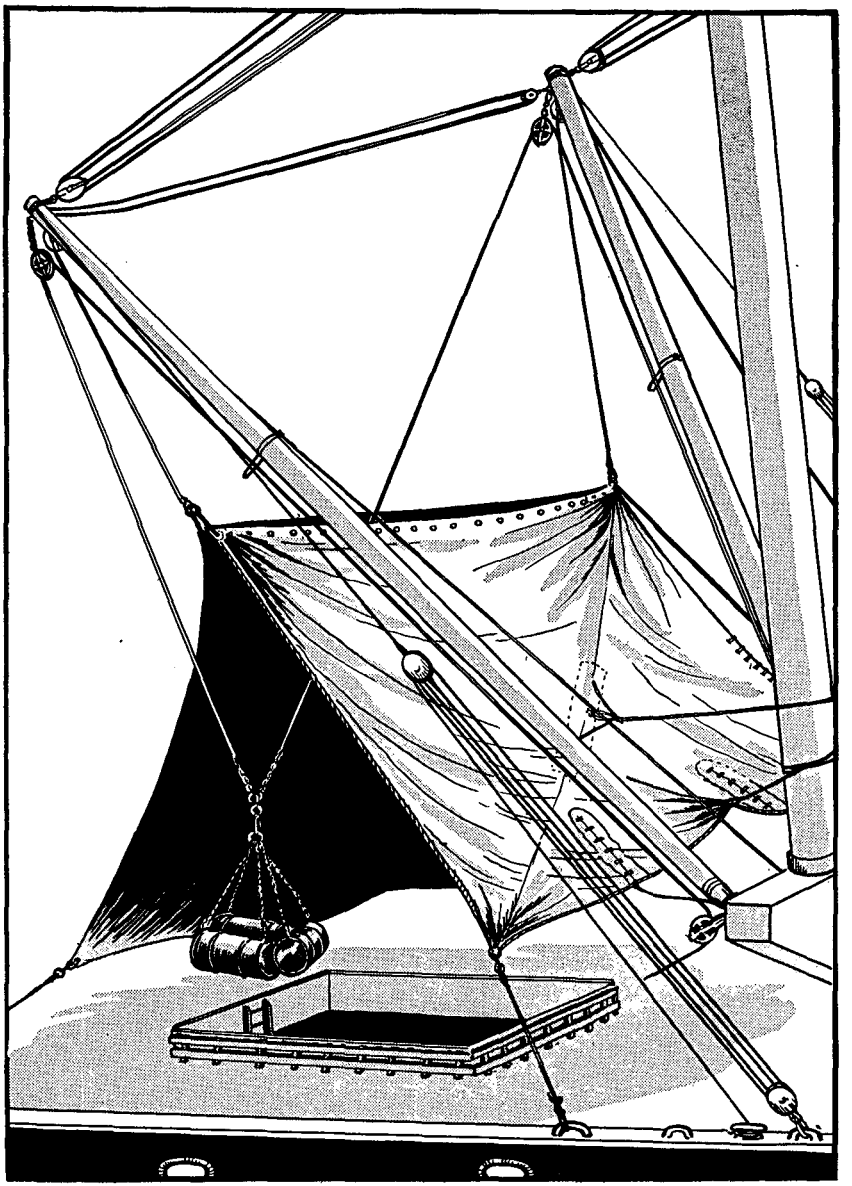


Figure 50. "West coast" hatch tent.

102. METHOD OF RIGGING "WEST COAST"-TYPE HATCH TENT

a. The first step in the erection of a "west coast" hatch tent is to secure gantlines to the heads of both booms (fig. 50).

(1) The gantline is a length of rope, 3½-inch circumference, reeved through 10-inch wooden blocks secured to the link band at the head of both booms.

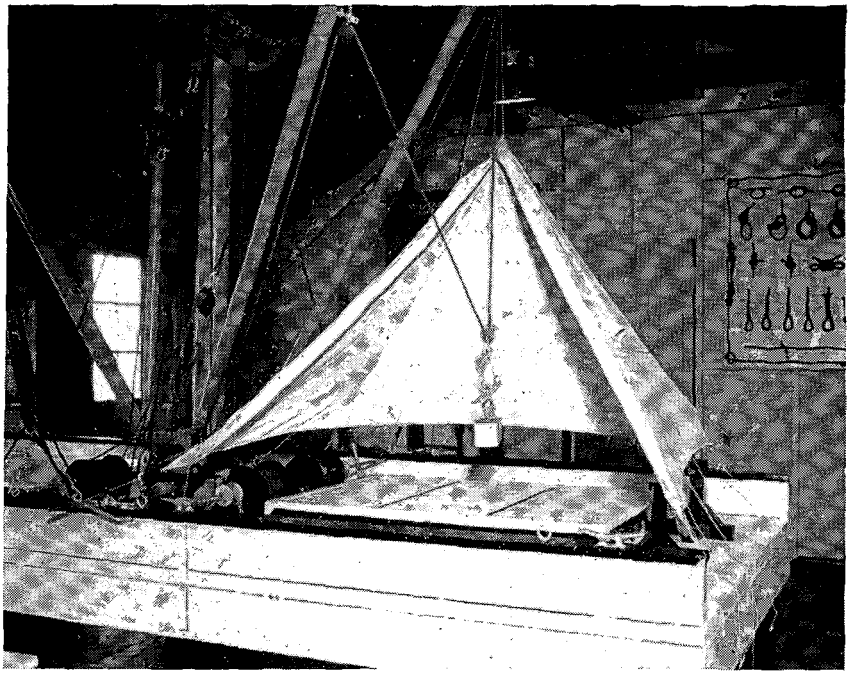


Figure 51. "Pyramidal" hatch tent.

(2) These blocks hang on the offshore side of each boom. From the wharf, both blocks should be seen on the sides of the boom away from the wharf.

b. The tent is hoisted aboard by the ship's falls, and the hatch gantline is tied to the large shackle of the metal shoe which is constructed in the rear peak of the tent.

c. The tent is then hoisted on the hatch gantline about halfway to the head of the boom.

(1) The tent should be spread out while it is being raised.

(2) The hatch runner is inserted between the ridges of the tent.

(3) The hatch gantline is heaved up until the bottom of the tent is above the deck.

(4) The heavy backstay of the tent is pulled taut, and the gantline is secured.

d. The front of the tent is now hoisted by use of the outboard fall and gantline.

(1) This gantline is secured to the front peak of the tent.

(2) Hoisting is continued until the ridge of the tent runs straight across—that is, parallel with the deck.

(3) Next, the outboard gantline is secured.

e. The final operation consists of spreading the tent to cover the hatch opening completely. Heavy guy lines and lighter lanyards are available for this purpose.

(1) The guy lines, located on the corners and center of the sides and back, are tightened and secured.
(2) The intermediate lanyards are now adjusted to keep the tent straight and to prevent sagging.

103. ADAPTABILITY OF THE "WEST COAST"-TYPE HATCH TENT

a. The "west coast"-type hatch tent is equipped with reeve points and laced-up openings so that it is adaptable to practically any size hatch. Openings in the sides of the tent which may be unlaced form a protective flap over the heads of the winchmen.

b. Hatch tents should be used whenever practicable since they protect cargo. The hatch tent at best, however, is only a temporary protection; when work at a hatch is discontinued in inclement weather, the hatch should be covered with its regular hatch beams, boards, and tarpaulins.

104. "PYRAMIDAL"-TYPE TENT

This type has been used for many years and protects only a portion of the hatch, allowing rain or snow to fall on the cargo opening necessary for working cargo. It also has the disadvantage of acting as a wind scoop when wind is blowing directly into the opening of the tent. Visibility and free action of cargo falls are restricted, making operation of cargo booms and winches more difficult.

Section X. SAVE-ALL NETS

105. USE OF SAVE-ALL

a. The save-all is a device used to prevent the loss of cargo overboard during loading or discharging operations.
(1) The most common type of save-all is a rope net, 15 by 20 feet or larger.
(2) Wire rope nets and wooden platforms are also used as save-alls.

b. Save-alls should be rigged at each working hatch and beneath each gangplank, skid, or conveyor.

c. In a stevedoring operation, thousands of drafts and tens of thousands of individual packages or items of various shapes and sizes are handled. Individual packages or even an entire draft may be accidently dumped overboard during the course of operation.

106. METHOD OF RIGGING

a. The most efficient manner of rigging a save-all is by use of the ship's falls:
(1) The top center of the net is hooked, and the net is hoisted until it is even with the ship's rail (fig. 52).

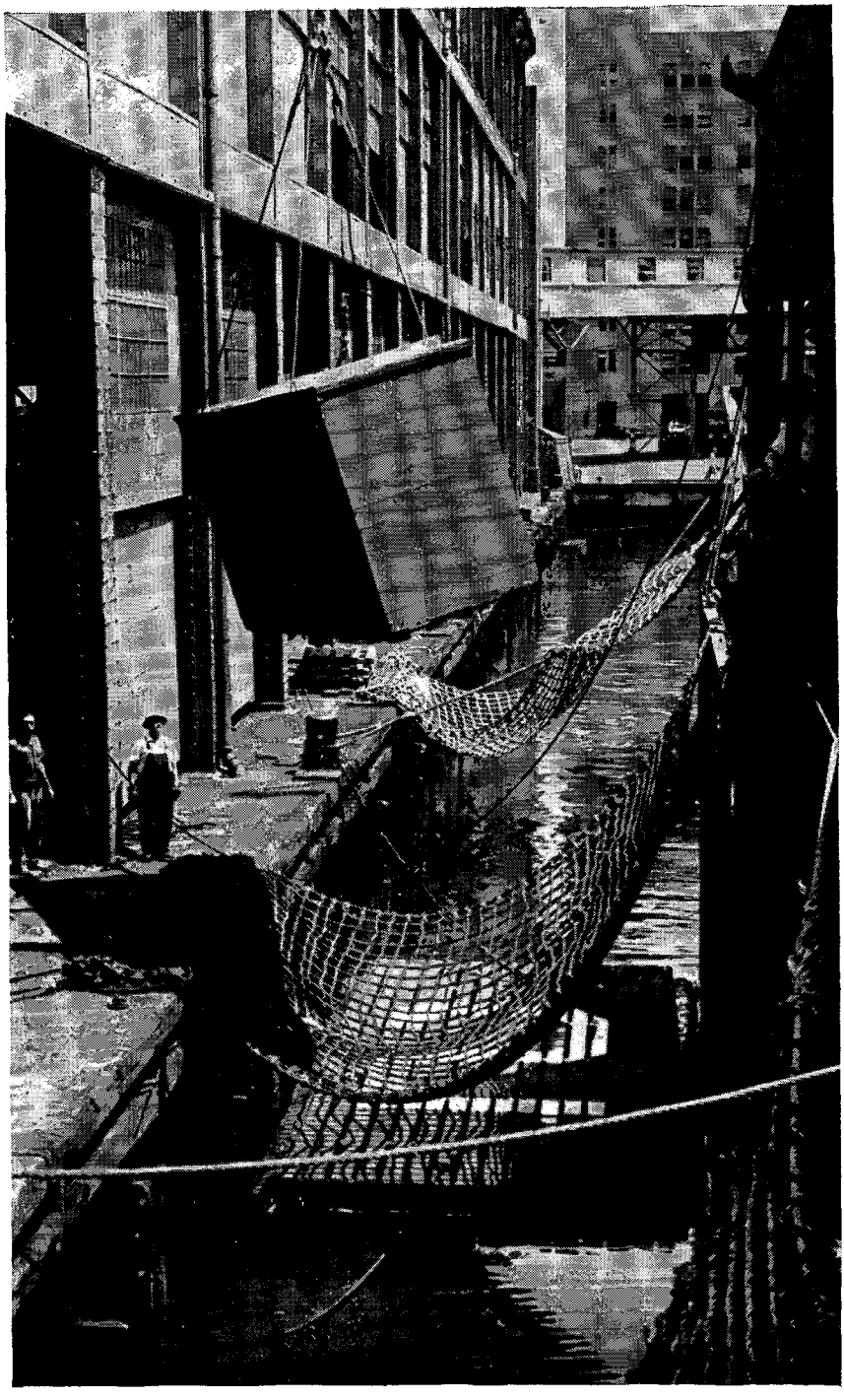


Figure 52. Rope save-all rigged for use.

(2) The lanyards or lashings are next secured to cleats on board, and the net is slacked off.

(3) The bottom of the save-all is then secured to the stringer on the pier.

b. Sufficient slack should always be left in the save-all to prevent its being carried away should the tide or current move the ship higher, lower, or away from the pier. In parts of the world where extremely high tides are common, it is necessary to slack off or tighten the lashings frequently during the change of tide.

107. IMPROVISED SAVE-ALLS

If save-all nets are not available, substitutes should be improvised before the cargo is worked. Several cargo nets lashed together make an excellent save-all. Wooden platforms or skids can be quickly built, and the time required in construction is more than repaid in the saving of cargo. If light packages or bulk cargo, such as grain, are being moved, a hatch tarpaulin may be quickly rigged as a satisfactory expedient.

Section XI. RIGGING EXPEDIENTS

108. DAMAGED SHIP'S GEAR

Failure of the ship's gear because of overloading or improper maintenance is not uncommon. Occasionally, enemy action will cause serious damage to ship's facilities for handling cargo. Army stevedores must be prepared to discharge the ship's cargo even though booms have been carried away or otherwise damaged. In this section, the various improvisations for replacing ship's gear are discussed.

109. BELLY TACKLE

a. The belly tackle rig is an improvisation which will substantially increase the working efficiency of the hatch and thus speed the discharge of the vessel's cargo (fig. 53). This type of rigging employs two falls working from a single boom. It can be extremely valuable under conditions in which only one boom is available for use over a hatch. When this type of rigging is used, one fall operates through a block at the head of the boom; the other fall operates through a block attached to the middle of the boom. It is strongly recommended, when using the belly tackle, that substantial preventer guys, in addition to the regular guys, be placed on the hatch boom to offset the additional side thrust caused by the increased load.

b. This tackle is rigged as follows:

(1) A wire or rope tackle of sufficient length is provided to allow the lower block of the tackle to be attached to the boom while it is in a horizontal position.

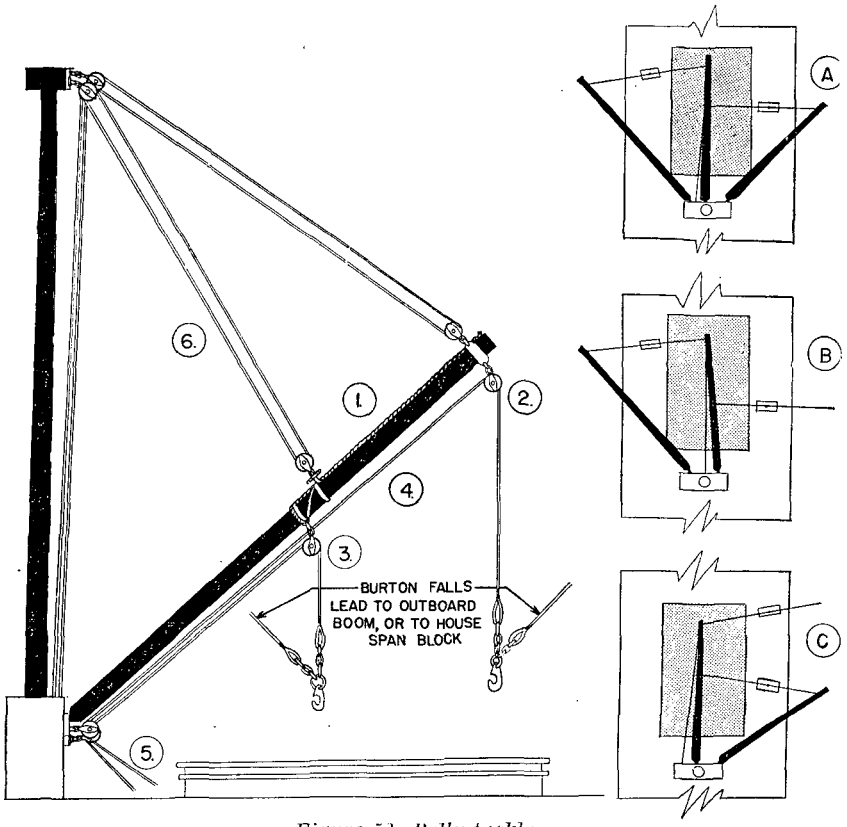


Figure 53. Belly tackle.

(2) The upper part is fastened to the masthead, and the hauling part of the tackle is secured on the masthead.

(3) Tackle should be taut at all times.

(4) The lower block of the belly tackle is fixed to one of the two necessary straps secured around the boom.

(5) The other strap supports the lower shackle cargo block.

(6) A backer of 3-inch manila rope, or equivalent, of sufficient length is placed around the boom below the lower strap and hitched to the head of the boom.

(7) A fall is led through the block, then to the regular heel block of the boom, and to the winch.

(8) The hatch falls through the lower block and head block are secured to the falls which are led to outboard booms or house-span blocks.

(9) The fall leading from the block at the head of the boom must be led to an off-center heel block to prevent cutting the strap below the block.

(10) The off-center lead can be improvised by the use of wire straps attached in the desired position.

110. THE FLYING BLOCK

a. The flying-block rigging can be used for lightweight drafts encountered when speed of movement is desired (fig. 54). The load will travel swiftly when this type of rigging is used.

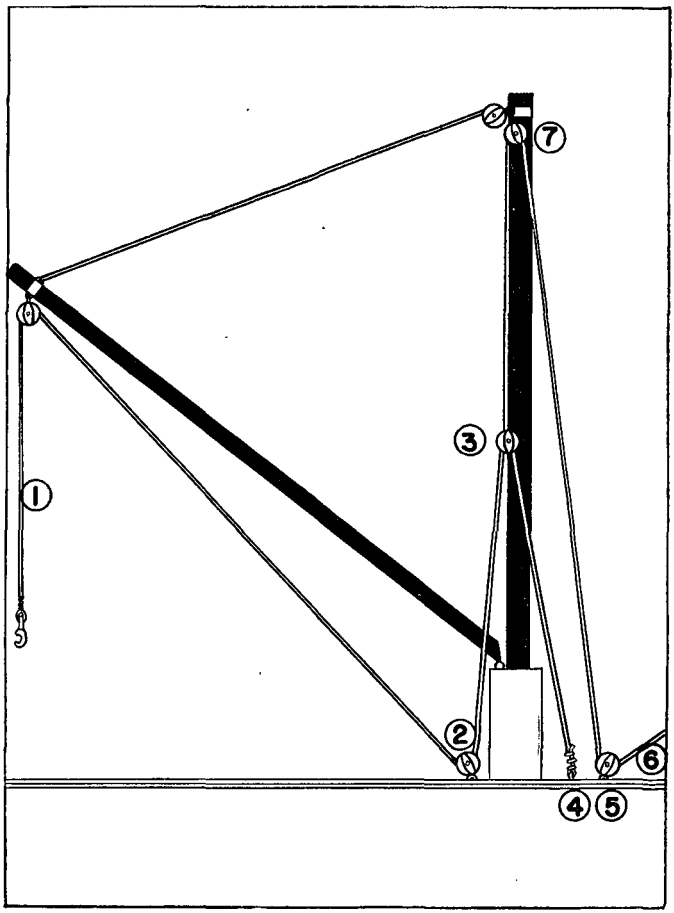


Figure 54. Flying block.

b. The flying-block improvisation is an inverted gun tackle purchase and operates upon a theory directly opposite to the purchase theory—that is, two or more blocks and tackles are used to reduce the power and strain required to lift a specific load. When the purchase rig is employed, the load travels slowly and the necessary power is decreased. When the flying-block rigging is used, the load travels faster and the rig power is increased.

c. The flying-block rigging has been successfully used in coaling vessels when the load hoisted was approximately one-half the normal weight of the general cargo draft. It should be remembered, however,

that this rigging is an improvisation for a specific purpose and is not recommended for use with regular cargo operations.

d. Alertness is advised when using this method because of the speed of the draft.

e. The flying block is rigged in the following manner:

(1) The regular cargo runner is reeved through the head block of the boom to the heel block, through the fly block, and attached to a pad-eye.

(2) The fall must be long enough to permit the hook to reach the maximum depth required.

(3) The flying block is supported by a fall attached to a shackle of the flying block; it is led through a masthead or span block, through a heel block on deck, and then through the power.

f. Adjustments will be required, when this rigging is used, to allow the fly block sufficient travel. This travel is determined by the distance the cargo hook attached to the cargo runner will have to run.

111. IMPROVISED FALLS OVER HATCH

a. A disabled or broken hatch boom often can be replaced by rigging a stay tackle over the square of the hatch and hanging an ordinary head block over the stay.

b. Figure 55 illustrates use of this method on No. 1 hatch.

(1) A stay is rigged from just above the cross trees of the foremast to a point on the forecastle head. The anchor windlass is an excellent point to secure the stay as the gypsy head would then be used to take the slack out of the wire. Also, the wire could be secured to bits and a turnbuckle used to remove the slack.

(2) The stay should be of good quality, 7/8 or 1-inch wire rope. If necessary, lighter wire may be used, but the safe capacity of the gear would be less than 2 tons.

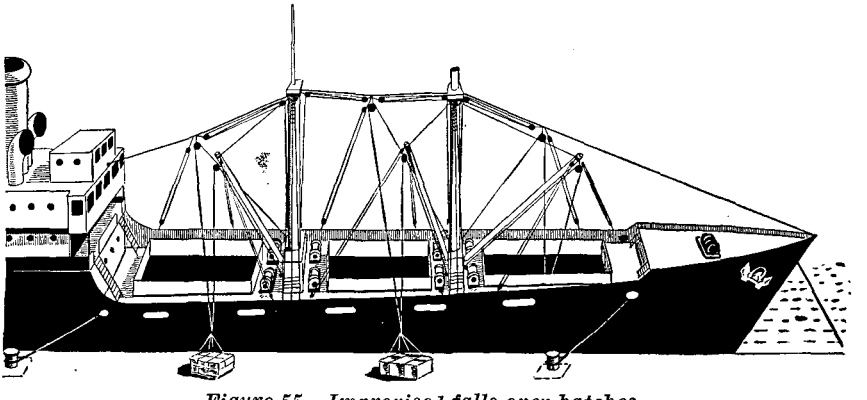


Figure 55. Improvised falls over hatches.

(3) When the stay has been erected, an ordinary block is shackled to the wire, hauled up the stay by the block and tackle to a point over the square of the hatch, and then secured.

(4) The runner reeved through this block can then be used to hoist cargo out of the hold, and operations can progress with the one boom available at the hatch in a typical yard and stay method.

c. The rigging of a No. 2 hatch would be accomplished in a similar manner to the rigging of No. 1 hatch.

(1) The stay would be run from the foremast to the mainmast.

(2) Two blocks and tackle would be required to spot the head block, as required, over any position in the hold below.

(3) The slack could be taken out of the stay either by leading it through a block on the cross trees to the cathead of a winch, or by using a turnbuckle aloft.

d. A stay over a No. 3 hatch would run from any secure point atop the bridge to the head of the mainmast. It is deemed advisable to back up the block hung in the stay with a guy tackle led to the offshore rail of the ship. This is necessary to keep the stay from undue strain when the load is racked across the deck.

112. MARRIED FALLS IMPROVISATION

a. The married falls improvisation may be used when power from only one winch is available (fig. 56). It is slow by comparison with the usual married falls operation and is recommended only as an expedient until normal operation can be resumed.

b. Loading can be accomplished by reversing the application of the power and falls.

(1) Booms, guys, and the up-and-down fall are rigged by the usual method for married falls.

(2) The outboard fall is led to a cleat in a location providing a clear view for the man attending the fall.

(3) The draft is hoisted by the up-and-down fall to a point sufficiently high to permit it to swing in an arc, using the distance from the head block on the burton boom to the hook as a radius.

(4) The burton fall is hauled hand tight and held with sufficient turns on the cleat or lowering spar to hold the entire weight of the draft when the up-and-down fall is slacked off, allowing the draft to swing into position under the head block of the burton boom.

(5) The slacked-off, up-and-down fall allows the draft to swing in an arc to its outboard position.

(6) The draft is then in a position to be lowered directly to the dock or conveyance by slacking off the burton fall.

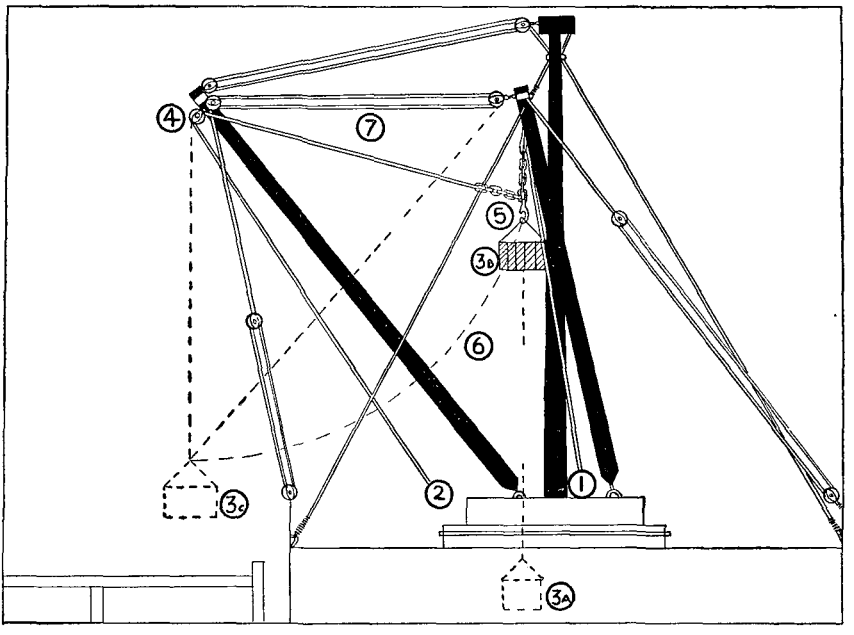


Figure 56. Improvision of married falls method of rigging.

(7) Care must be exercised that the draft is landed properly the first time, since power is not readily available to raise it.

c. The blocks used in connection with the rope burton fall should have a rope-scored sheave for use in this operation.

d. The midship guy is attached to the booms to keep them properly spaced, instead of using the usual two guys attached to the deck.

113. REPLACING DAMAGED WINCH WITH TRUCK ON WHARF

a. Winch failures are not uncommon in oversea ports, and repair often is made difficult because of the lack of replacement parts. When it is desired to work both booms at a hatch where one winch is out of order and still not slow operations at an adjacent hatch by using one of its winches, a truck on the wharf is used to replace the damaged winch (fig. 57).

b. The following procedure is used in making this replacement:

(1) The ship is rigged for yard and stay operations.

(2) The runner from the outboard boom is led either direct or through a system of snatch blocks to a tractor or truck on the wharf.

(3) The runner is secured directly to the truck or tractor, and the vehicle is moved either backward or forward to raise or lower the drafts.

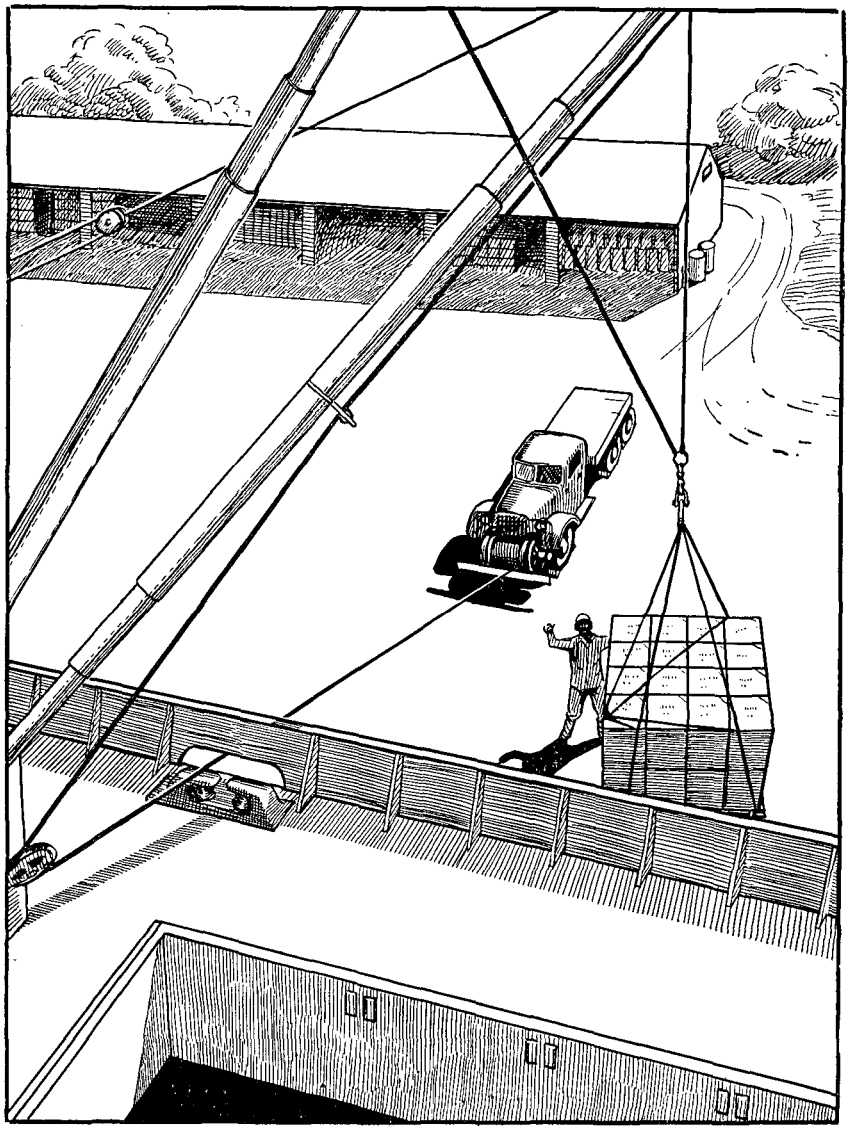


Figure 57. Truck used on wharf to replace damaged winch.

(4) A fairlead to direct the runner close to the deck or the wharf may be required to prevent the wheels of the vehicle from lifting under the weight of the draft.

(5) A second signalman on the wharf may be necessary.

c. In the event there is not sufficient space available for a runway, an alternate method of attaching the runner to the winch of the truck may be used. This method is extremely slow.

114. IMPROVISED HOUSE FALL

a. If a ship to be discharged has a disabled or broken boom, an improvised house fall can be rigged to perform the function of the outboard boom. Materials required include a stout piling or pole used as a vertical member and substantial lengths of wire or rope as guys and stays. This material is easily obtained around any port installation. Piling, telephone poles, or even a tree may be used.

b. The erection of the structure can be accomplished by use of the ship's gear (fig. 58).

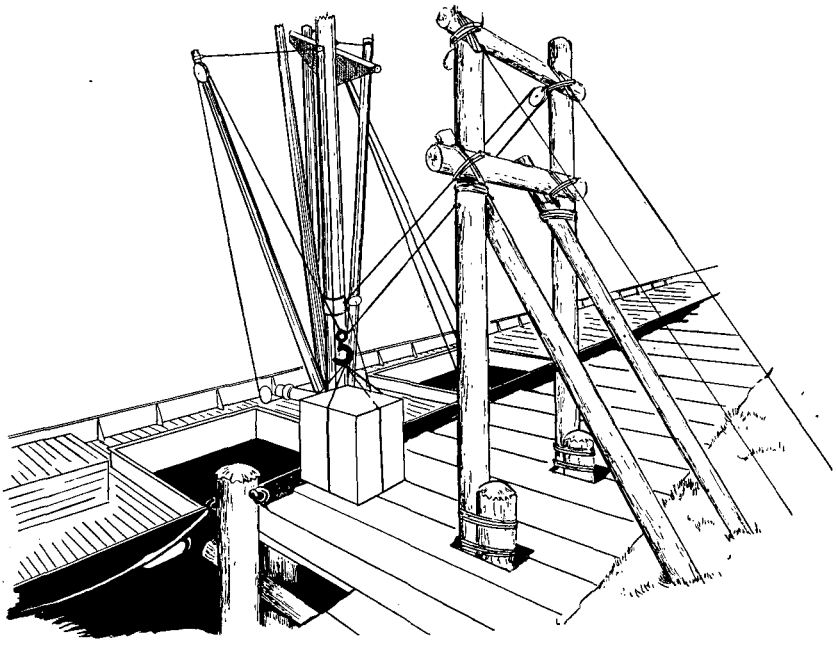


Figure 58. Improvised house fall.

(1) Once the structure is in position, a heavy block is lashed to the top.

(2) The runner from the outboard winch is looped through it and married to the runner working from the boom.

(3) The rigging is now essentially the same as the yard and stay house-fall system.

c. This type of cargo mast or house fall can prove of invaluable assistance in expediting discharge of vessels.

(1) It can be used to discharge a vessel with a disabled boom.

(2) It permits the working of cargo to any point on the wharf between the string piece and the foot of the structure itself in a location where a wide apron is available.

(3) Congestion is prevented at the point of discharge, allowing the pier gang to load several trailers or trucks simultaneously.

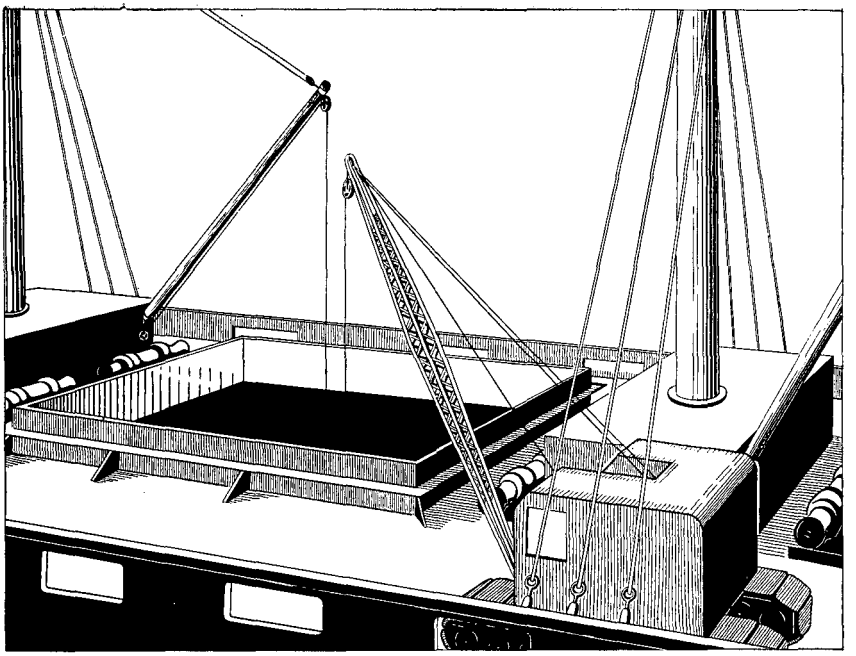


Figure 59. Crane used on board ship.

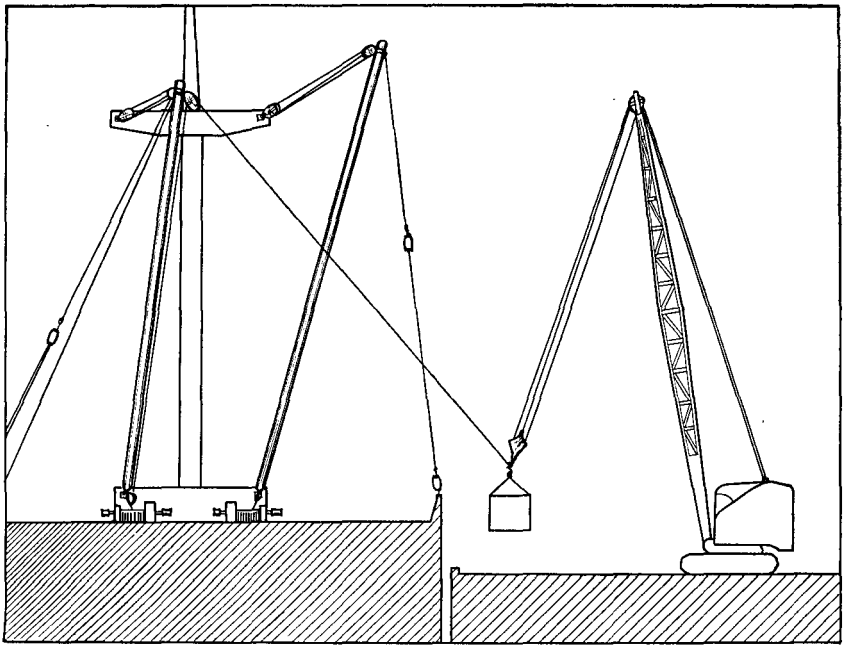


Figure 60. Crane used as burton span.

115. USE OF CRANE ABOARD SHIP

a. A crawler or land crane may be placed on deck of a vessel between the hatch coaming and the rail to expedite the working of cargo (fig. 59). This crane may be used to double up the hatch by working cargo in addition to the regular cargo gear, or may be used with one cargo boom to provide a yard and stay method (fig. 60).

b. Limiting factors in this operation are the weight and size of the crane and the pressure it will exert on the vessel's deck.

116. SINGLE SWINGING BOOM

A single swinging boom may be used as an expedient in the event that one cargo boom becomes inoperative, or one winch at a hatch is damaged. Refer to paragraph 79 for the method of rigging.

CHAPTER 7

CARGO HANDLING GEAR

Section I. TYPES AND APPLICATION

117. CLASSIFICATION

Cargo handling gear is defined as the aids used with the ship's cargo gear to load or discharge cargo. This gear may be divided into three classes:

a. All-purpose gear which can be used for many types of cargo.

b. Special-purpose gear which is designed for use on one type of cargo.

c. Cargo handling aids which are provided to assist the individual stevedore in handling cargo.

118. SELECTION OF CARGO HANDLING GEAR

a. Proper use of cargo hoisting or cargo handling gear, essential to prevent damage to cargo and injury to men, means selection of the right gear for the job and correct use of it.

b. In large ports the proper use of gear does not present the problem it may in smaller ports where the proper gear is not always available. Stevedores may use the wrong kind of gear simply because it is handy. This can be overcome by training and conscientious supervision.

c. After the proper gear has been selected, it must be checked for defects and replaced or repaired if defective.

119. MULTIPURPOSE GEAR

a. Endless Rope Sling (fig. 61). A length of line spliced to form an endless strap is an endless rope sling. This type of sling was used before the more specialized gear recently developed.

(1) Its tendency is to crush cases, and it may become frayed and weakened from contact with sharp edges.

(2) It is passed around a draft of cargo, the long end being passed through the short end bight, then placed on the cargo hook. When necessary, a long end may be shortened by taking a bight of the line in each hand and tying it into an overhand knot (sling shortener).

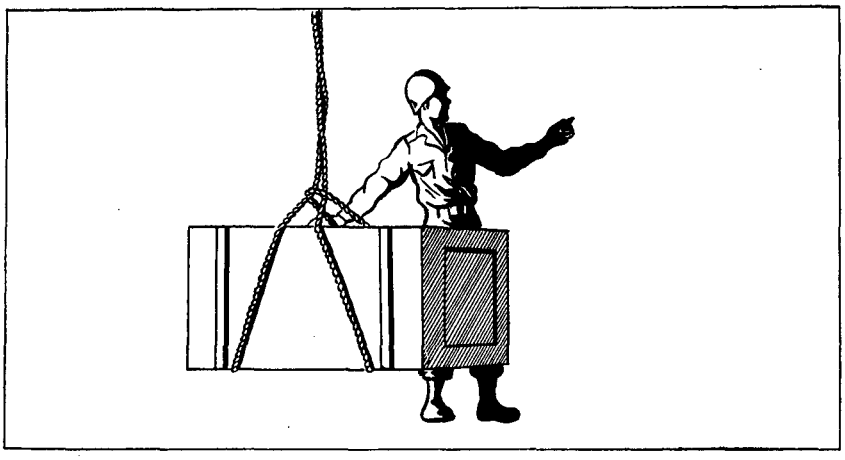


Figure 61. Endless rope sling.

b. Wire Sling (fig. 62).

(1) The wire sling is used—

(*a*) To hoist irregularly shaped pieces of 100 pounds or less.

(*b*) To hold individual heavy lifts weighing 300 tons.

(*c*) In bridles.

(*d*) In cases requiring only the use of a single leg. It may vary from a small 3-foot strap with a wire splice in each end to a single wire leg of 50 feet.

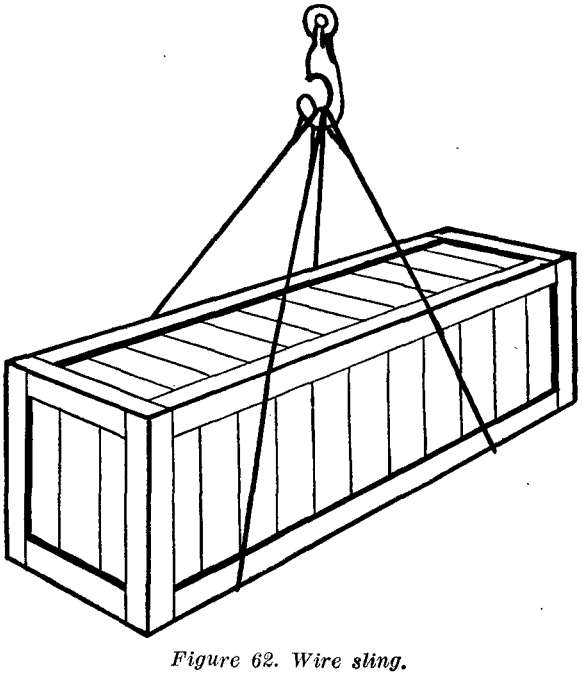


Figure 62. Wire sling.

(2) Consideration must be be given to pressure, abrasion, and slipping. Wire abrasion is caused by movement of a wire leg over a sharp or abrasive surface without sufficient protection to wood or padding at the sharp corners found at the bottom of pieces being hoisted.

c. Beam Bridle (fig. 63). The primary function of a beam bridle is to remove hatch beams from their sockets.

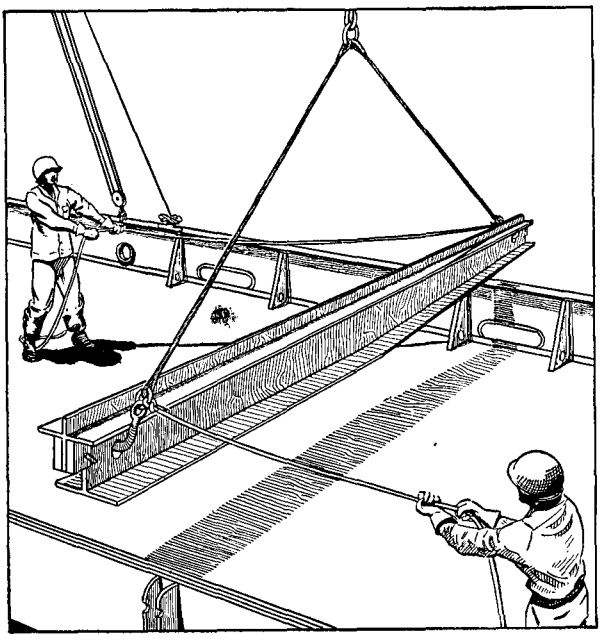


Figure 63. Beam bridle.

(1) To remove a beam, the hooks are placed on the opposite sides of the beam in the lightening holes or rings as provided.

(2) The hooks should be placed back to back when picking up the beam.

d. Canvas Sling (fig. 64). A canvas sling is a rope sling with a section of canvas sewn between ropes, and is used to handle bagged cargo to prevent the rope from cutting into the bags.

e. Chain Sling (fig. 65).

(1) The chain sling is used for handling steel items, such as rails, pipe beams, and angles. In handling rails or a number of lengths of pipe, a round turn should be made and the hook placed around the chain.

(2) One disadvantage of the chain sling is that the links may crystallize and snap without warning; therefore, chain slings should be handled carefully and should not be exposed to cold temperatures for long periods of time.

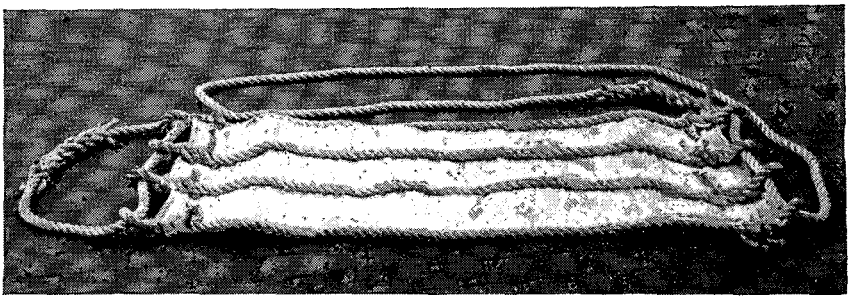


Figure 64. Canvas sling.

(3) Dunnage should always be used between the chain and the draft to provide a complete surface.

f. Cargo Net and Pie Plate (fig. 66).

(1) Cargo nets are used when loading nonuniform packages.

(2) Another use of the cargo net is in discharging into amphibious trucks or motor-cargo trucks. In such an operation, the net remains in the truck with its load and is carried to a dump for unloading.

(3) Barrels and drums are occasionally discharged by nets.

(*a*) If barrels are discharged with cargo nets, care should be taken to keep the pressure from their heads.

(*b*) Steel nets should be used on drums, since a rope net would be cut by the drums.

(4) In order to reduce the crushing pressure on the packages contained in a cargo net, pie plates are used (fig. 67).

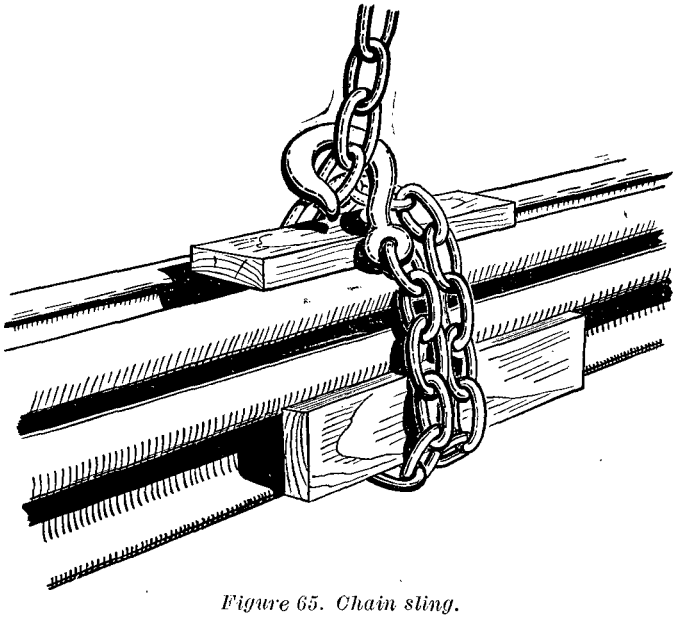


Figure 65. Chain sling.

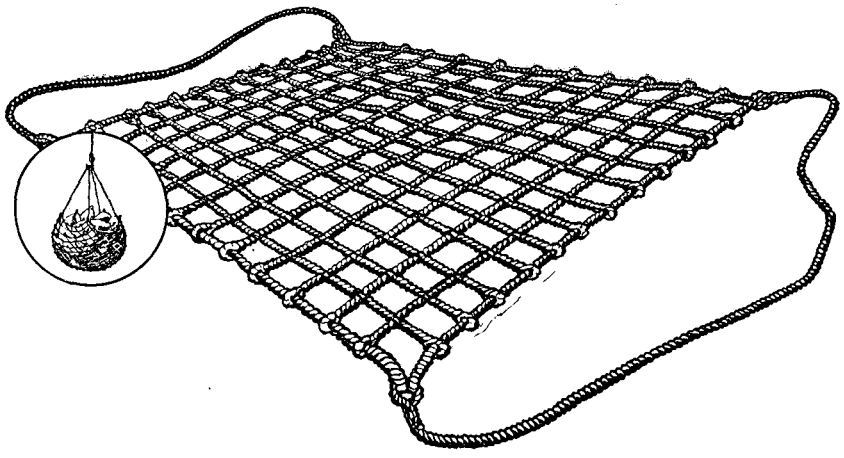


Figure 66. Cargo net.

g. Running Hook Sling (fig. 68).

(1) This gear is used for handling pipe, dunnage, steel, or any item which requires a good gripping action.

(2) In using this gear in pairs, the hooks should pull from opposite sides of the draft.

h. Box Hooks (fig. 69).

(1) Box hooks are placed over the edges of a case in a manner similar to attaching drumhead hooks on drums. These hooks must not be used on fragile cases.

(2) This gear is used for lifting heavy cases a few feet and should not be used to carry cases over the side of the ship.

(3) Box hooks are best used in conjunction with the dragline or to lift a box to a place where it may be more easily slung.

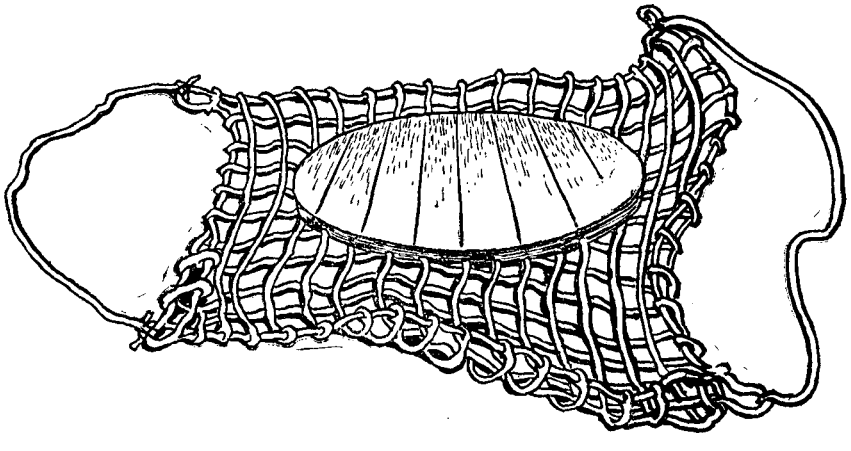


Figure 67. Cargo net and pie plate.

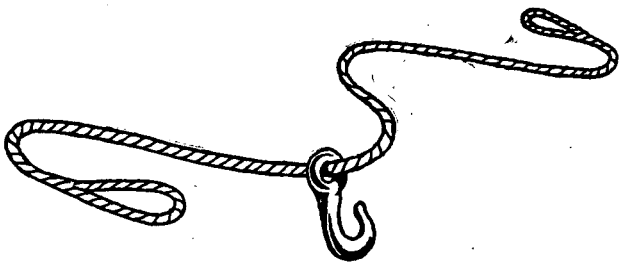


Figure 68. Running hook sling.

120. SPECIAL-PURPOSE GEAR

a. Drum Hooks.

(1) Multiple sets of drum hooks are used to handle drums.

(*a*) As many as eight drums can be slung on a draft (fig. 70).

(*b*) The drafts should be adjusted so that all the drums are at approximately the same height.

(*c*) The drums should be placed so they will not shift.

(2) Very often the drum hooks are hung from a spreader bar. This bar can be straight or built in the shape of a square.

(3) When used on barrels, the hooks should be wide enough to prevent injury to the barrels.

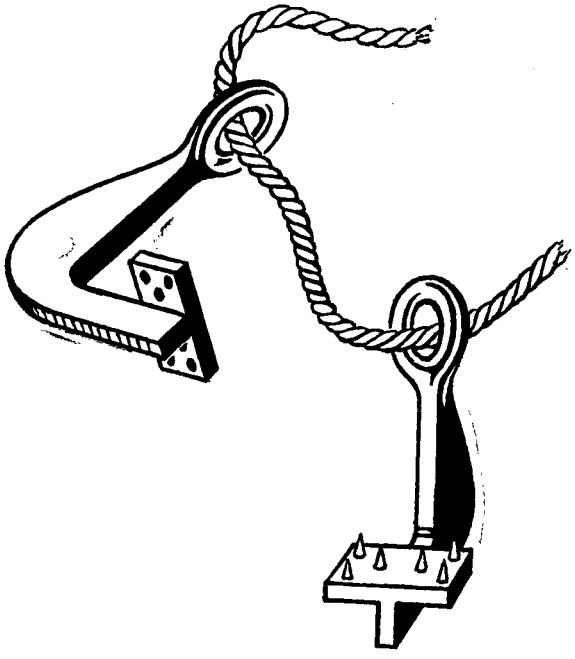


Figure 69. Box hooks.

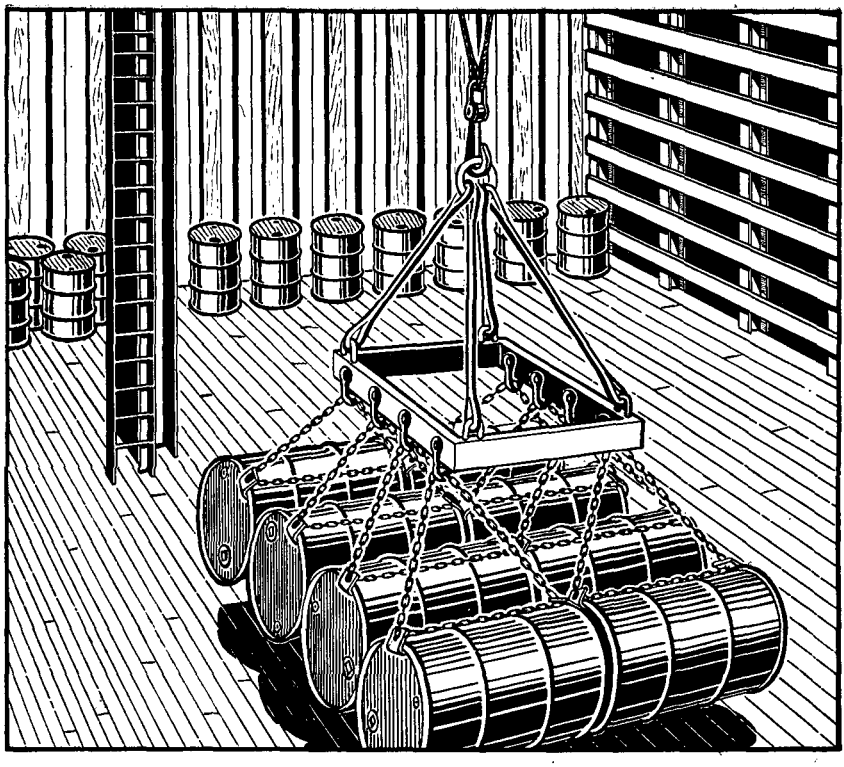


Figure 70. Slinging eight drums on drum hooks.

b. Bomb Sling (fig. 71).

(1) Unlike other gear, there are very few items other than bombs for which this specialized gear is adaptable.

(2) This sling can be made from either rope or wire.

(3) For small bombs, the multiple bomb sling is permissible (fig. 72); but as the weight of the bombs increases, the number of bombs per draft must be decreased.

c. Pallet Bridle. This is a specialized gear designed for the quick and efficient handling of palletized cargo. Figure 73 illustrates a pallet bridle with a spreader. This type is heavy and cumbersome, but is of value when handling especially fragile items on a pallet. The spreader tends to reduce damage from crushing. Figure 85 shows the use of a bridle without a spreader. This type is the more widely used of the two.

d. Animal Hoisting Gear. Gear for hoisting animals is of two types—

(1) The canvas sling which fits under the belly and between the legs of the animal.

(2) The flying stall, which is a stall fitted for hoisting with the ship's gear (fig. 74).

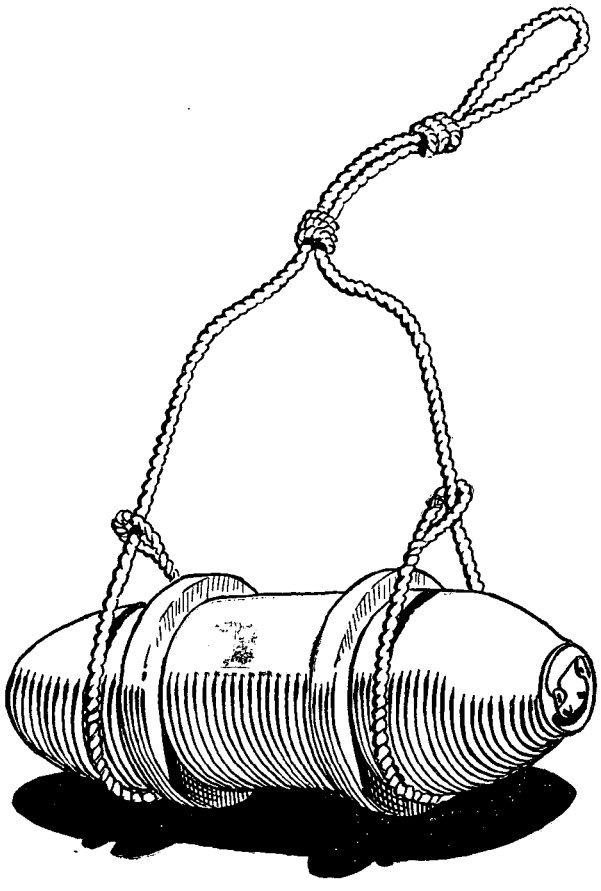


Figure 71. Bomb sling.

e. Wheel Nets (fig. 75). Wheel nets are used for wheeled vehicles when the use of straps might result in damage to the vehicle.

121. CARGO HANDLING AIDS

a. Hand Hooks (fig. 76). Hand hooks should not be used on fragile packages, such as cartons of cigarets, breakfast cereals, canned goods, and other cargo that may be damaged by the hooks. In no case should the hook be used in handling ammunition.

b. Spreaders (fig. 77).

(1) Spreaders are used—

(*a*) When it is necessary to reduce a side pressure against a vehicle.

(*b*) On pallet bridles to relieve pressure on the side of the draft.

(2) Wire clips are placed on the sling above and below the spreader to prevent slipping.

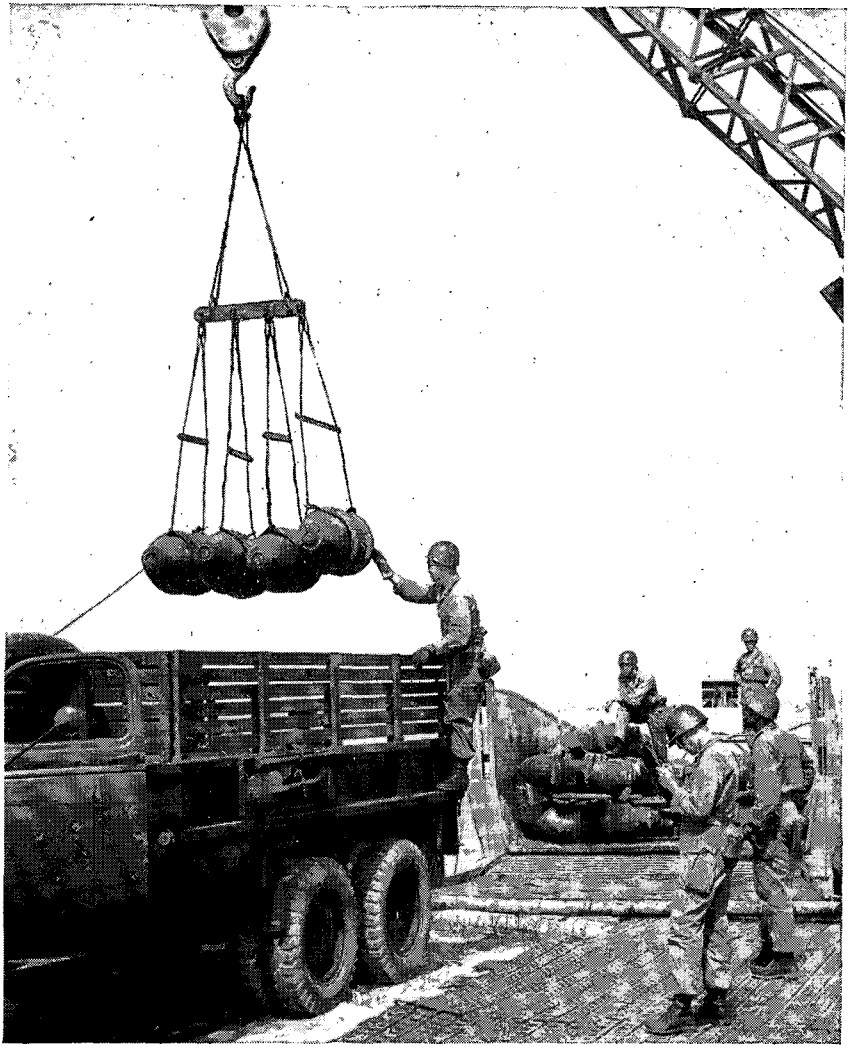


Figure 72. Multiple bomb sling.

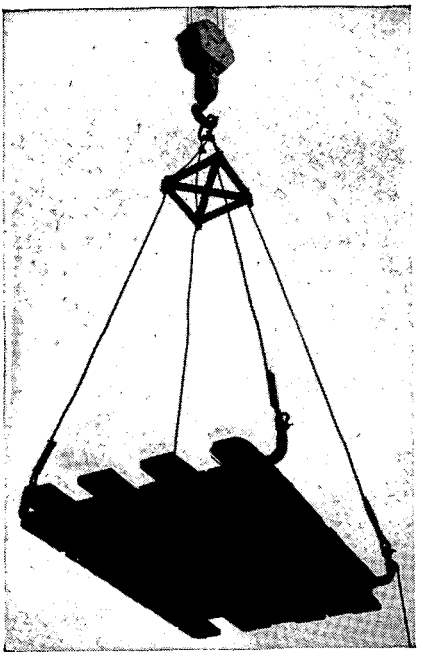


Figure 73. Pallet bridle with pallet.

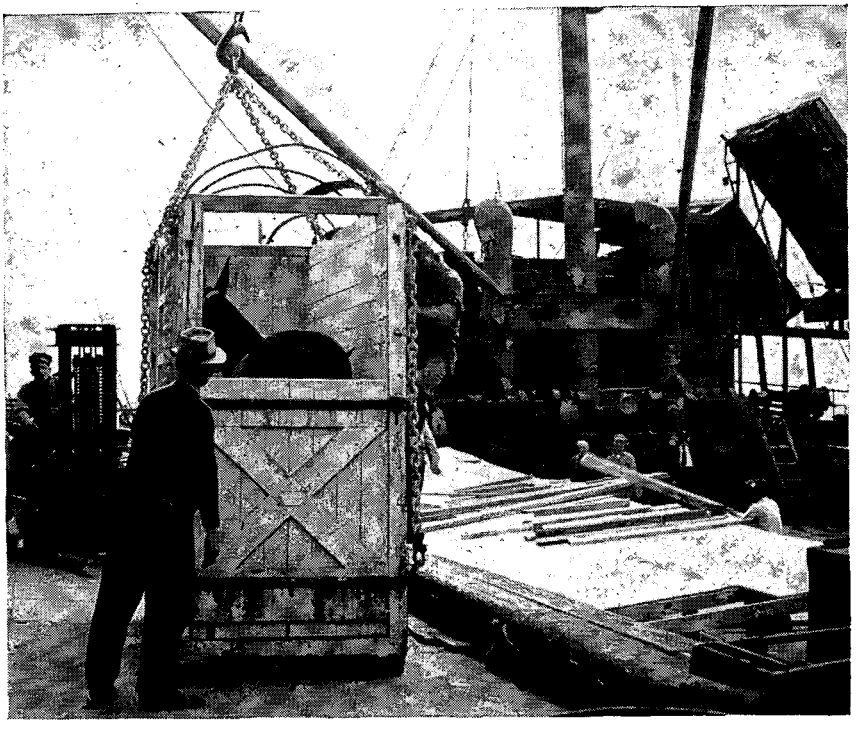


Figure 74. Flying stall for animals.

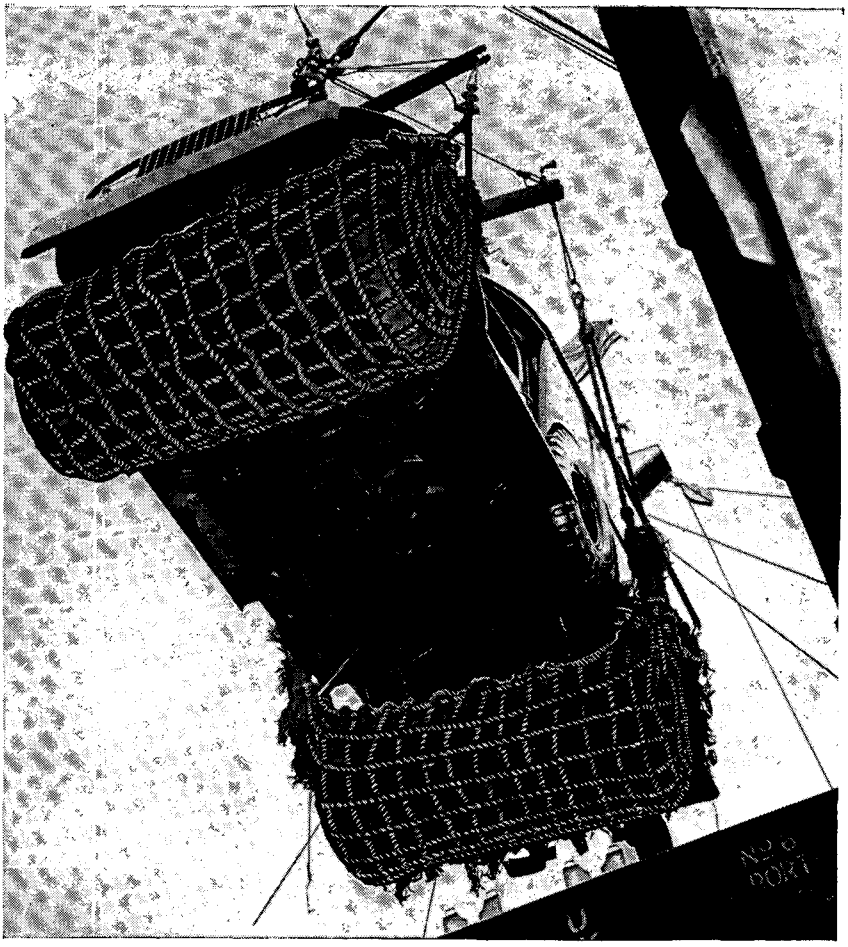


Figure 75. Wheel nets.

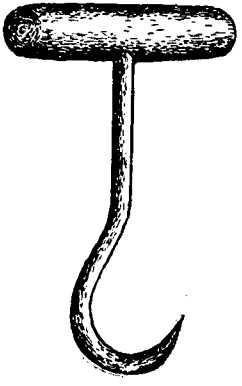


Figure 76. Hand hook.

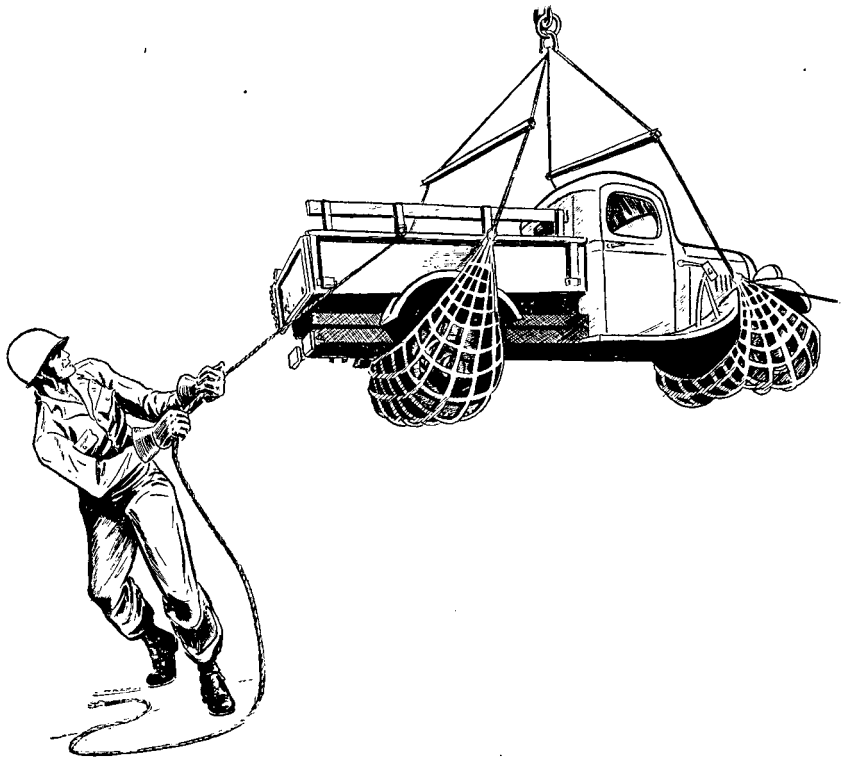


Figure 77. Spreaders.

c. Crowbars and Pinchbars. Crowbars and pinchbars are used to move or lift heavy items of cargo by placing the bar under one end and lifting upward and outward. Figures 78 and 79 illustrate the use of a pinchbar. Crowbars are similar to pinchbars except that they are straight with a wedge-shaped working end. Caution must be exercised to prevent the toe of the bar from damaging cargo when it is used as shown in figure 79.

d. Rollers (fig. 80).

(1) Rollers are round bars of wood, steel, or pipe used to move heavy cargo in a hold more easily.

(2) Turning may be accomplished by cutting the front roller in the direction desired and the second roller in the opposite direction.

(3) Rollers may be removed by lifting the item with a jack or crowbar.

(4) Rollers should never be straddled.

e. Roller Conveyors, Portable (fig. 81). Roller conveyors which come in sections save time in moving small boxes in a hold or a warehouse.

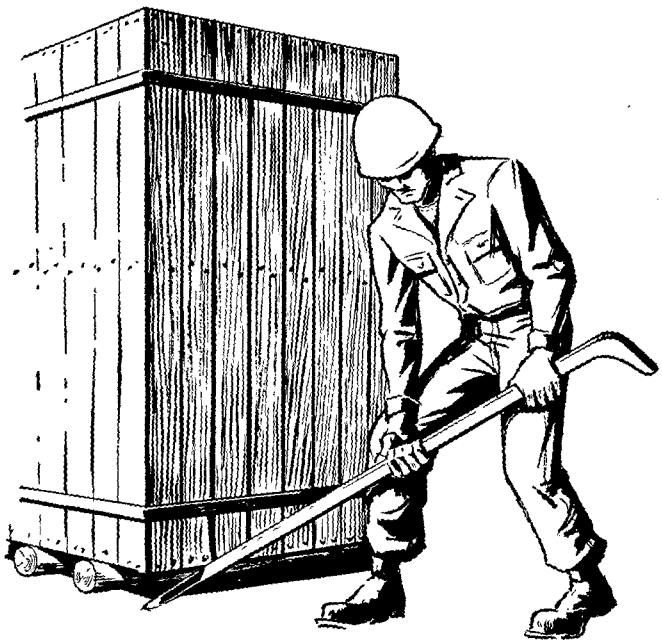


Figure 78. Moving heavy items with pinchbar.

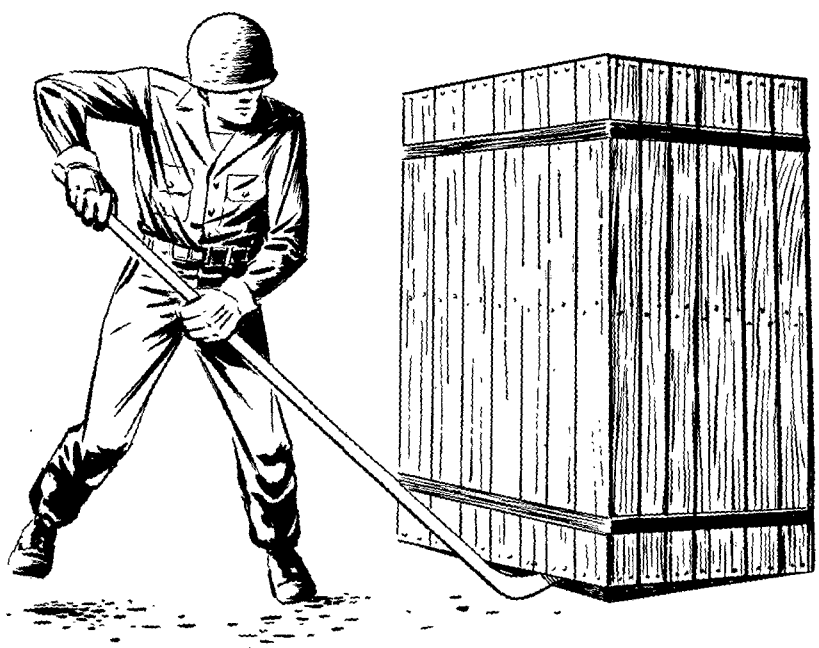


Figure 79. Lifting heavy item with pinchbar.

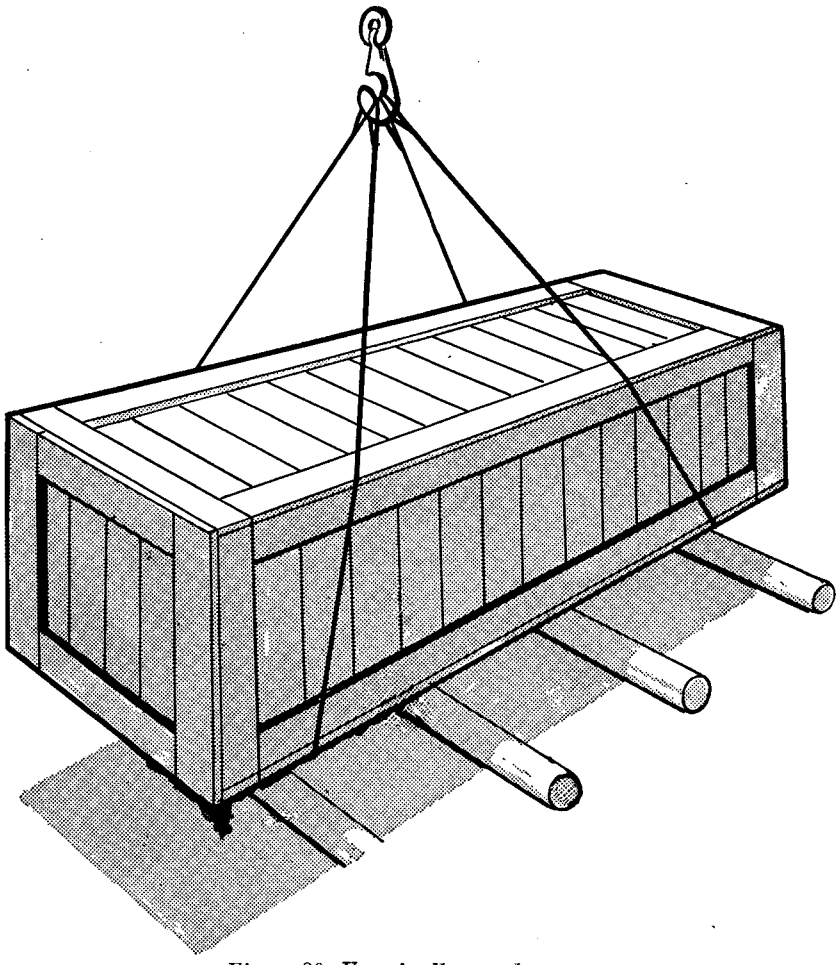


Figure 80. Use of rollers under a case.

122. CARE OF CARGO GEAR

Cargo gear will last longer if it has the proper care and maintenance. The following simple rules will prolong the life of the gear:

a. All parts should be kept lubricated.

b. Rope slings should be hung up to dry before stowing; they should not be stowed in damp places.

c. Excess strain in handling will seriously damage gear.

d. Wire rope should be kept lubricated to prevent the core from becoming brittle and to keep the rope pliable.

e. Daily inspection should be made of all gear to detect indications of wear. Repairs should be made before reuse.

f. Gear, when not in use, should be kept out from under foot to prevent damage.

Figure 81. Using portable conveyors to move small boxes from square of hatch to place of stowage.

Section II. FORK LIFT TRUCK

123. TYPES AND CHARACTERISTICS

a. The fork lift truck is a heavy-duty machine designed to lift, move, and stack items of cargo (fig. 82).

b. Fork lift trucks which may be assigned to Transportation Corps port companies range from 3,500-pound capacity to 15,000-pound capacity depending upon the type of unit, and have lifts ranging from 104 inches to 210 inches. Refer to T/O & E's 55–117 and 55–118 for further information.

c. Characteristics of fork lift trucks are as follows:

(1) Steering is done with rear wheels.

(2) The driver's seat is raised to provide a better view of forks and load.

(3) There is a small turning radius for working in close quarters.

124. USE

a. Fork lifts are used as stacking machines and in moving cargo to and from the cargo hook.

b. They are used most effectively at distances up to 150 feet.

125. OPERATION

a. Controls.

(1) The panel board is located directly beneath the driver's seat.
(2) The ignition switch is on the panel board.
(3) The clutch is on the left of the steering column, and the brake is on the right.
(4) The accelerator regulates both the speed of the machine and the speed of the raising and lowering of the forks.
(5) The crankshaft determines the two forward and one reverse speeds.
(6) The two short levers beside the driver's seat control the raising, lowering, and tilting actions.

b. Safety Precautions.

(1) Speed limit of fork lift trucks is 5 miles per hour.
(2) Forks should be parallel to and about 6 inches off the ground when traveling.
(3) Trucks should be operated on solid flooring.
(4) Loads should be tilted back against the frame (fig. 83).
(5) Trucks should be backed down a ramp.
(6) Sharp turns should be avoided when traveling, since trucks might capsize.

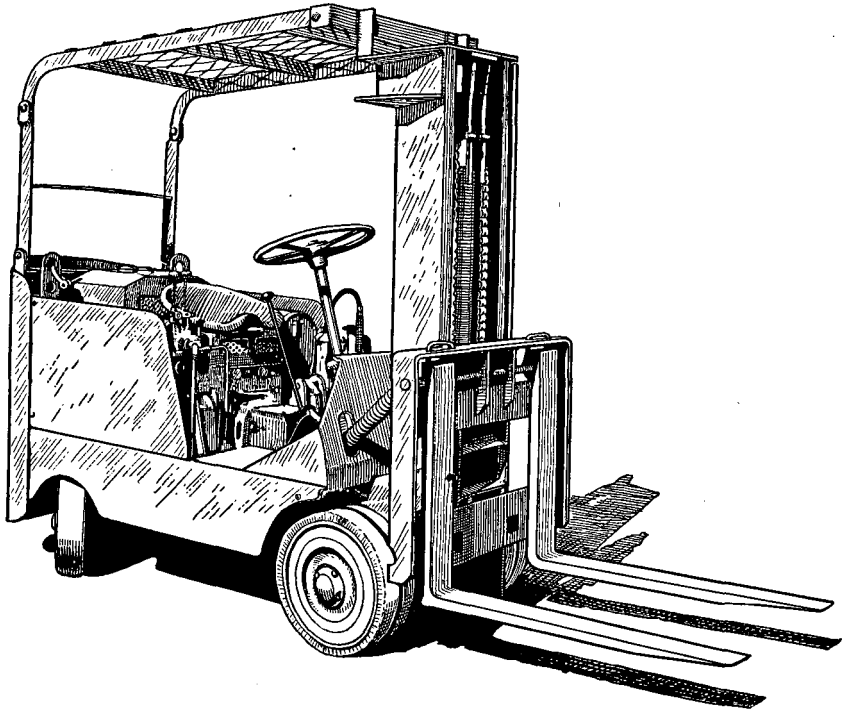


Figure 82. Fork lift truck, capacity 3 tons.

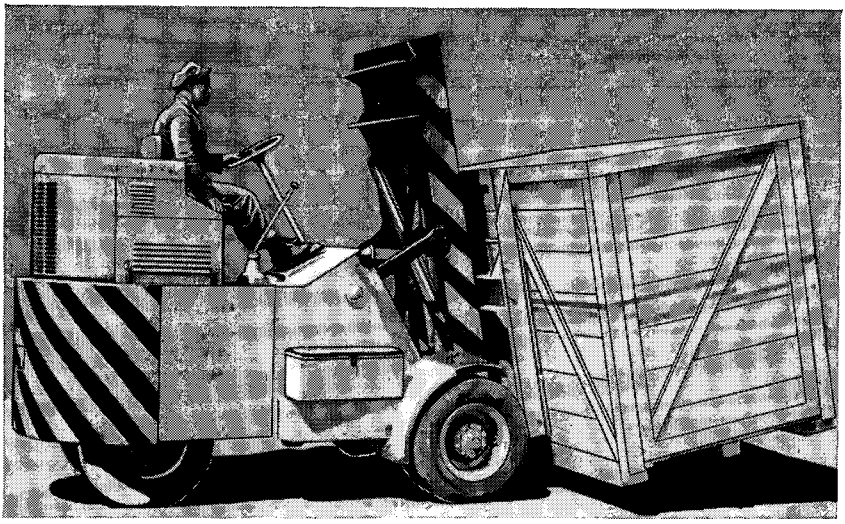


Figure 83. Proper way to carry a load on a fork lift.

(7) Sudden stops should be avoided when raising and lowering loads.
(8) When load obstructs view, trucks should be operated in reverse.

Section III. TRACTORS AND TRAILERS

126. TRACTORS

a. A tractor is a short compact vehicle used to afford a minimum turning radius. It is usually equipped with a sheet steel bumper and a towing hitch in the rear and may be equipped with a gypsy head.

b. Tractors are powered by gasoline or electric motors.
(1) The gasoline-powered type is best used outside where noise and the fumes of the engine will not interfere with workmen.
(2) Electric-powered tractors are excellent for warehouse use but require considerable maintenance.

c. Tractors do not have a high rate of speed because of the low gear ratio necessary for heavy hauling. When pulling a trailer train, a speed of 5 miles per hour should not be exceeded.

d. Tractors are used—
(1) As towing machines to pull trailer trains (fig. 84).
(2) For pushing or pulling heavy loads on skids or rollers.
(3) For moving railroad cars.

127. TRAILERS

a. A trailer is a small, wheeled vehicle for handling cargo on a very smooth surface (fig. 85). It is generally pulled with a tractor, but it

could be pushed as a four-wheel hand truck. The types most commonly used in stevedore operations have four wheels.

b. Trailers have coupling devices which are usually automatic in action, enabling the trailers to be coupled by pushing the rear coupling of one onto the rear coupling of the other.

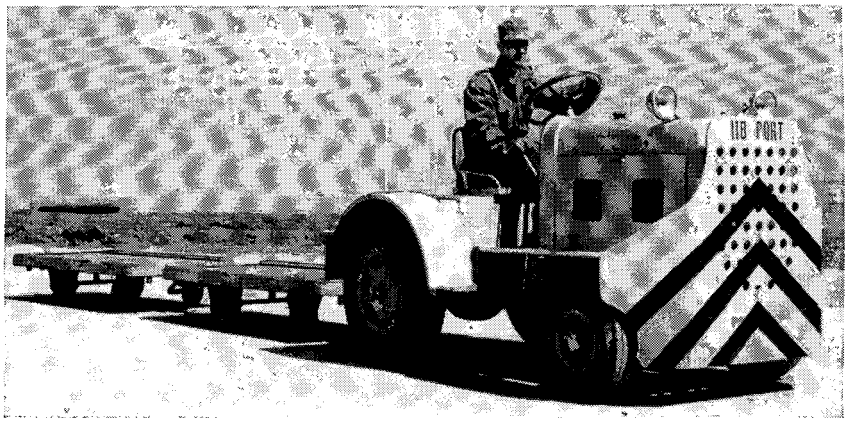


Figure 84. Tractor-trailer train.

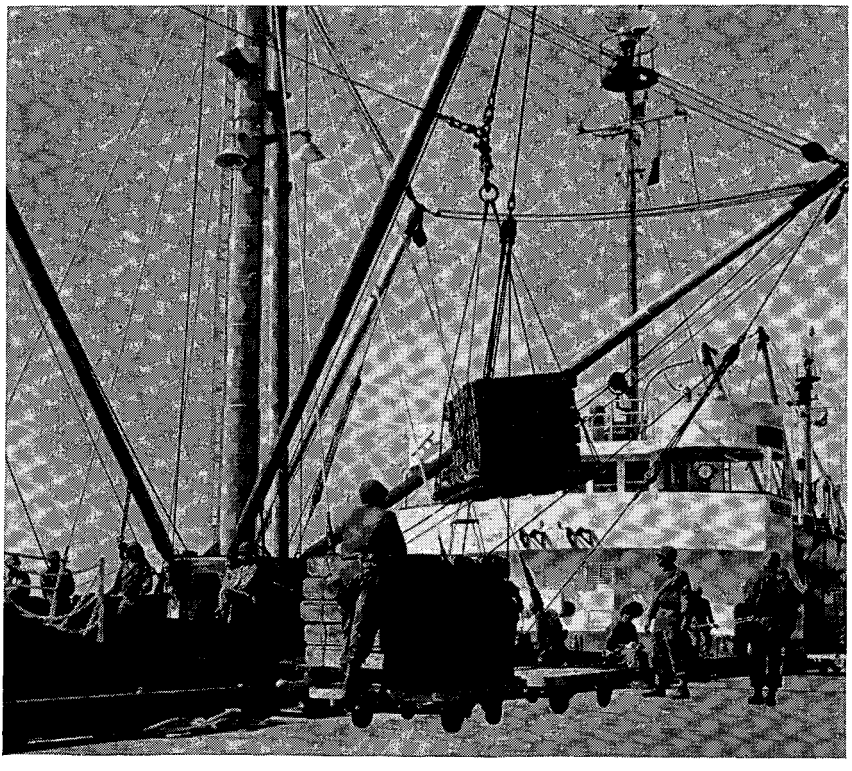


Figure 85. Trailers being used in a cargo operation.

Section IV. HAND TRUCKS

128. GENERAL

The hand truck is a two- or four-wheel vehicle of varying design operated by one man and used for the transfer of cargo.

129. USE

The two principal purposes of the hand truck are the movement of packages too heavy to be moved by hand and the transfer of greater volume of packages per shipment than can be accomplished by hand carrying (figs. 86 and 87).

Figure 86. Using a hand truck with bagged cargo.

Section V. LAND CRANES

130. TYPES

The types of land cranes most common in stevedoring operations are—

a. Mobile Crane. This is a truck-mounted crane and is used where mobility is desired. The mobile crane is quickly transferred from one location to another and can negotiate grades up to 30 percent. Lifting capacity is generally limited to 20 tons (fig. 88).

b. Crawler or Tractor Crane. This type of crane is mounted on tracks and is especially useful on beaches where a wheeled vehicle would bog down. There are several types, ranging from a capacity of 5 tons to a capacity of 50 tons (fig. 89).

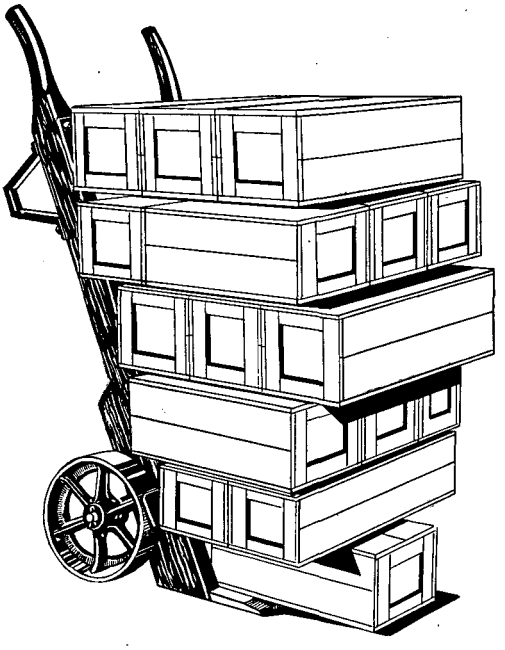


Figure 87. Using a hand truck with boxed cargo.

(1) A small tractor crane with a fixed boom and a capacity of 5 tons is useful in transit sheds and open storage areas.
(2) Larger tractor cranes with revolving basins and capacities ranging from 10 to 50 tons are extremely useful for unloading barges and landing craft at the water's edge or on a pier.

131. OPERATION

The lifting capacity of all types of cranes varies with the boom radius. For this reason, crane operators must be familiar with the safe working load at each given boom radius. This information is generally marked in the cab of the crane near the operator's seat. Because the operating level on many cranes used by the Army is arranged differently, no attempt is made herein to describe the actual mechanics of crane operation. TM 5–1197 may be used as a guide for operation and maintenance of various cranes.

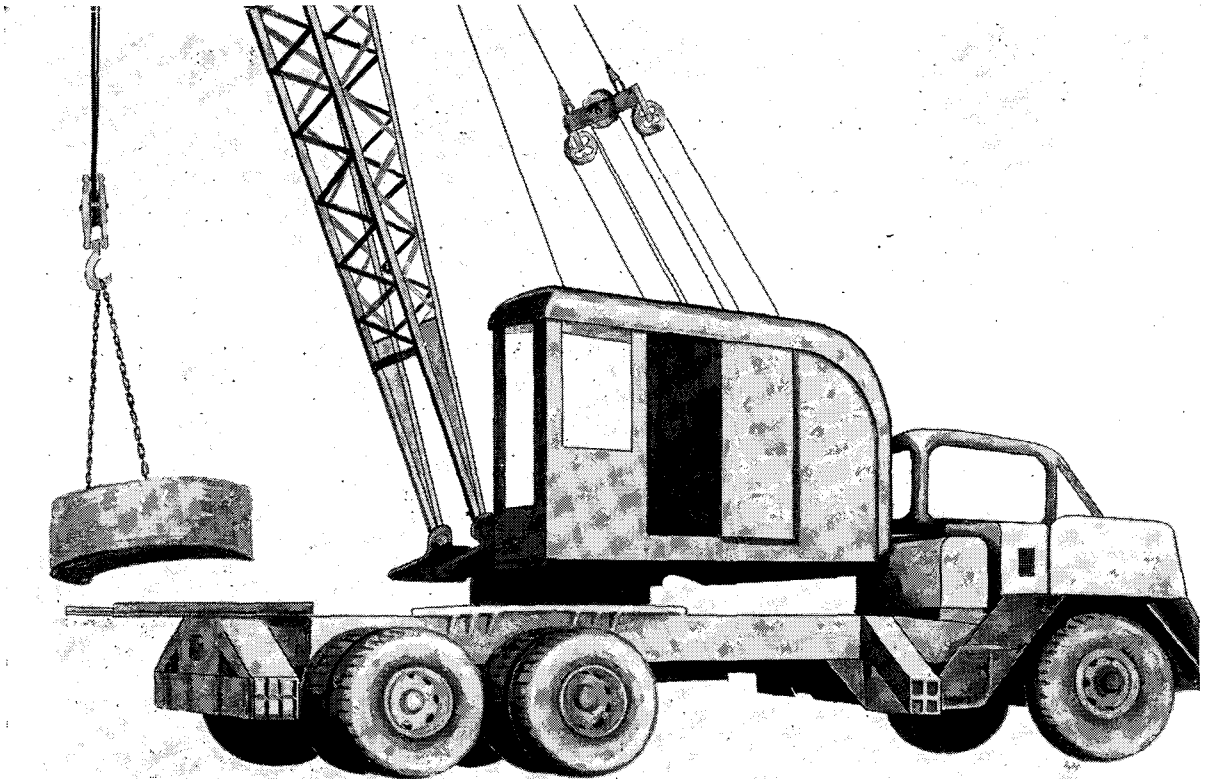


Figure 88. Mobile crane.

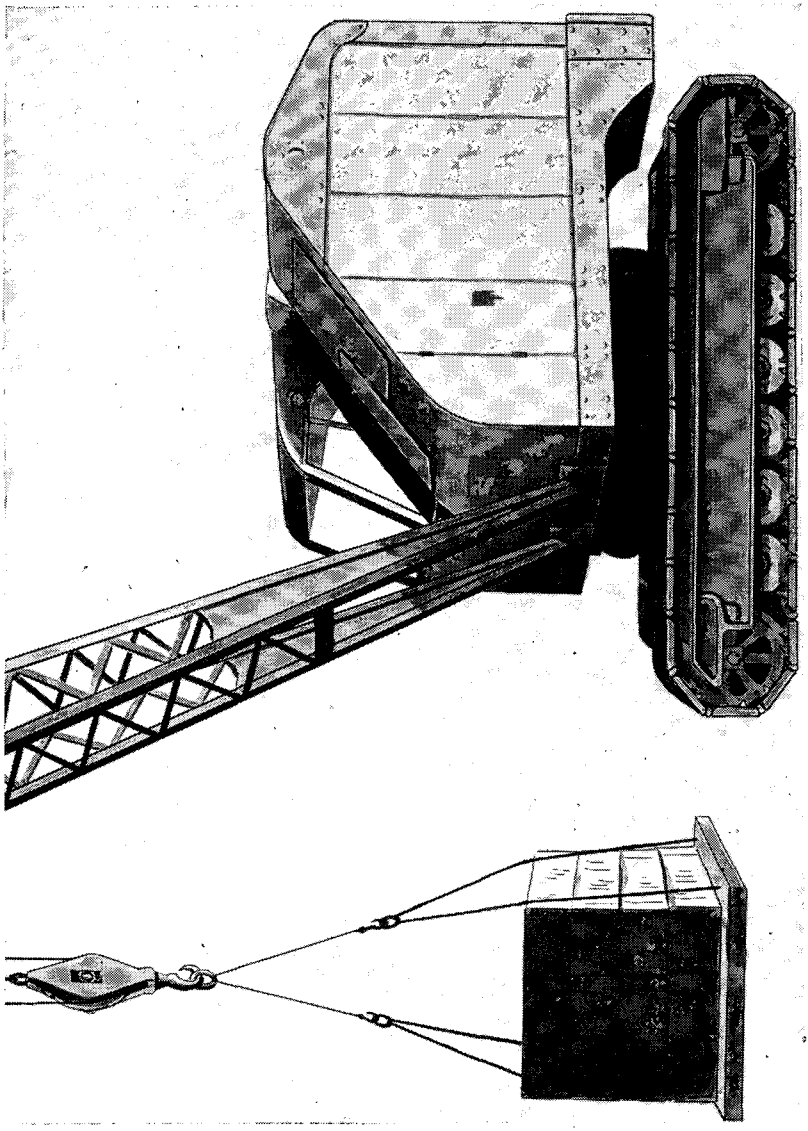


Figure 89. Crawler crane.

CHAPTER 8

CARGO HOLDS

132. HOLD NOMENCLATURE

The nomenclature of the forward and after holds of a vessel, identified in figures 90 and 91, should be thoroughly memorized.

133. OPENING AND CLOSING HATCHES

At best, the normal hatch opening or closing operation will take from 20 minutes to a half hour.

134. OPENING HATCHES

The procedure for opening hatches before working cargo is as follows:

a. Drive out the wedges and remove the battens.

b. Lay the battens on deck close to the coaming.

c. Gather all the wedges, and stow them in one place.

d. Remove tarps, one at a time, in the following manner:

(1) Grasp the edge nearest the winches and pull it all the way to the opposite end of the hatch.

(2) Grasp at the fold and again pull it to the opposite end of the hatch.

(3) Repeat this procedure until the tarp lies athwartship on the hatch in a folded strip 3 to 4 feet wide.

(4) Starting on the side of the deck over which the cargo is to be worked, fold tarp to the opposite side.

(5) Remove tarp from the top of the hatch and place it on a rack or on dunnage.

(6) Each succeeding tarp will be removed one at a time, as described above, and stacked on the first tarp, clear of the hatch (fig. 92).

e. Remove hatch covers.

(1) Remove the center sections first (fig. 93). Starting at the center of the hatch and handling the center sections of boards, two men will work the port side while two men work the starboard side.

(2) Two men on top of the hatch remove one hatch cover at a time and carry it to the coaming.

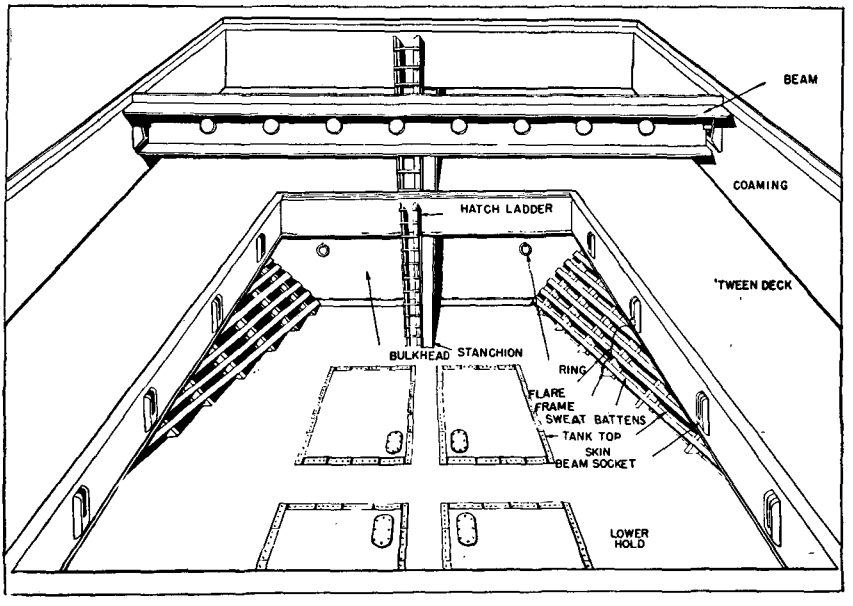


Figure 90. Forward hold.

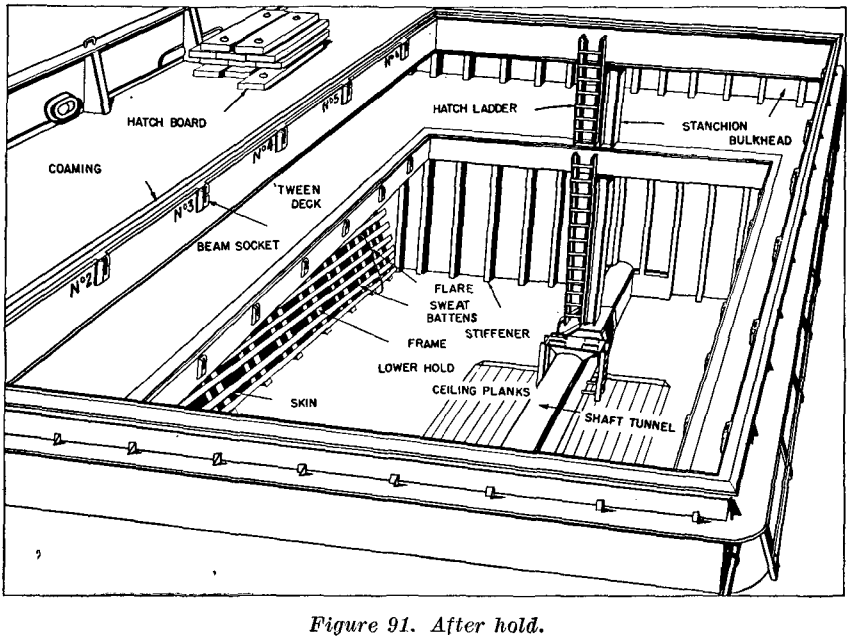


Figure 91. After hold.

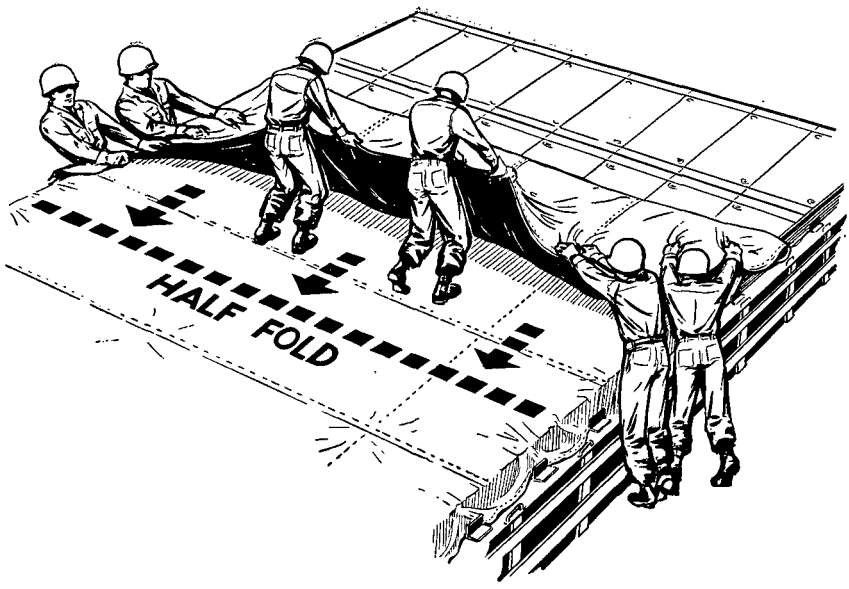


Figure 92. First fold of hatch tarpaulin.

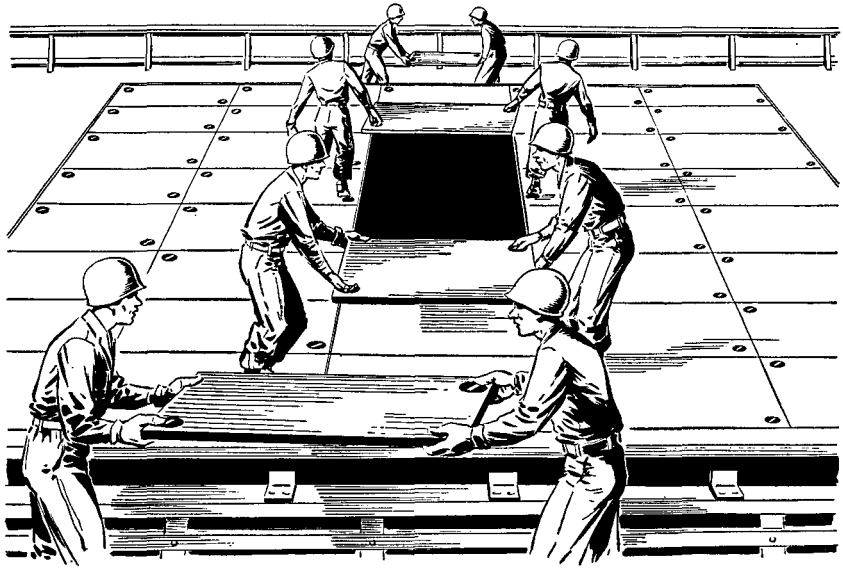


Figure 93. Removing center section of hatch boards.

(3) From this point, two men on deck take the board and place it against the bulwark.
(4) This procedure is repeated until all of the center section is uncovered.
(5) All hatch covers are placed next to the bulwark neatly and solidly. These stacks should not be so high as to topple over.

f. After uncovering the center section, each man, starting at the center line of the hatch, handles one board at a time from a stooped or kneeling position, turning it edge over edge to the coaming, and then carrying it to the rail.

g. The last sections of boards are handled in a similar manner, with the exception that the men on top of the hatch are able to stand on deck at the coamings fore and aft the hatch (fig. 94). On the side on which cargo is to be moved, a space should be left clear for the signalman to walk to the rail without standing on or climbing over the hatch covers.

h. Remove the hatch beams in the following manner:
(1) Assure that the beams are not locked in place.
(2) Hang the beam bridle with the tag lines attached to each leg on the cargo hook. A good practice to follow when hooking hatch beams is to hold the hook in the right hand (fig. 95). By following this simple rule, the hooks will automatically be placed on opposite sides of the beams, as is necessary in order to make them lift straight.
(3) Place dunnage, upon which the beams will be put, on deck at an opposite end from which the cargo is to be worked.
(4) Two or three men on each tag line then may drift the beams over to the side of the hatch.
(5) For safety, place beams on the sides neatly (fig. 96).

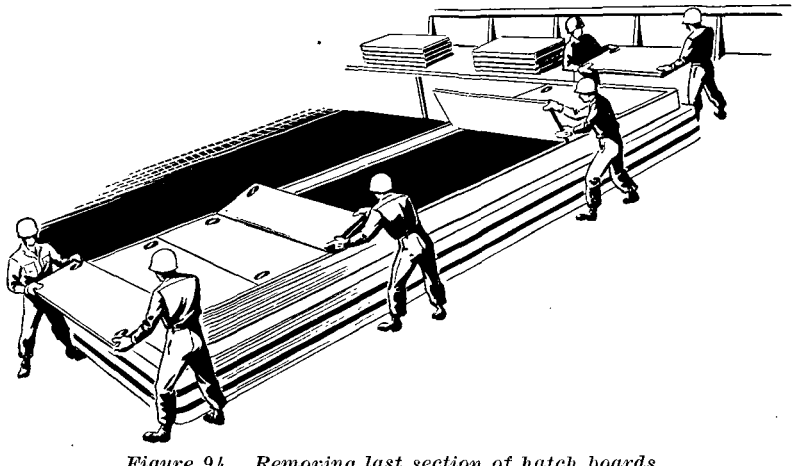


Figure 94. Removing last section of hatch boards.

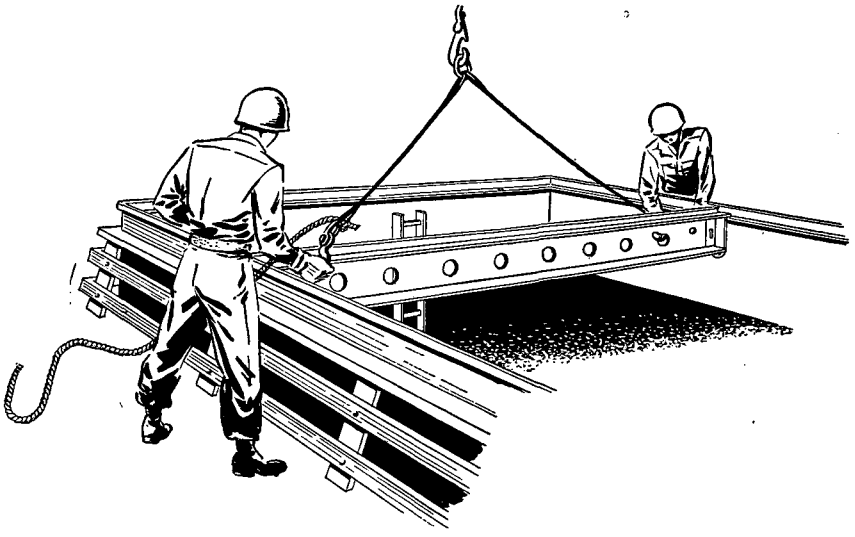


Figure 95. Hooking up a beam for removal.

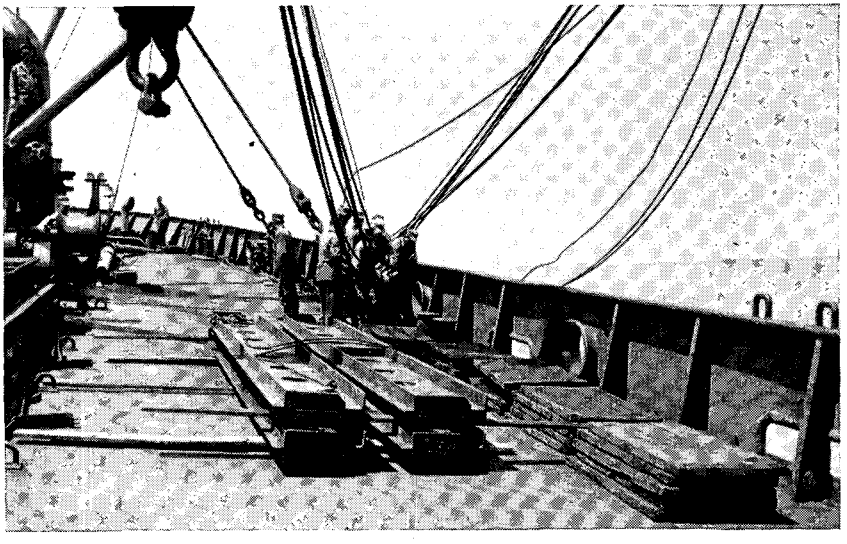


Figure 96. Hatch covers and beams piled on deck.

i. When the last beam is removed and there is no further need for the beam bridle, remove the bridle from the cargo hook and leave it in the beam.

135. CLOSING HATCHES

Before going to sea, the hatches of a vessel must be securely closed to protect cargo in the hold from sea, wind, and rain. The procedure for this operation is as follows:

a. In most cases there will be three or more tarpaulins placed over the square of the hatch.

(1) These are put on one at a time to remove folds and wrinkles.

(2) A good practice is to put the oldest tarp on top (outside) to protect those in better condition from being snagged or torn while deck cargo is being placed in the square of the hatch.

(3) The open edges of the seams are placed to face aft to prevent the sea from driving through (fig. 97).

b. After all the tarps have been placed, side battens are laid behind

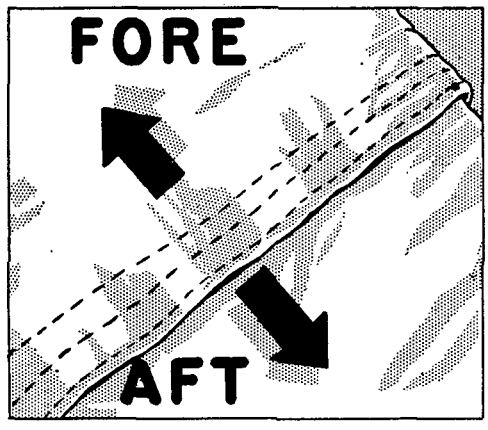


Figure 97. Facing of seam of hatch tarpaulin.

the cleats and wedged. The blunt end of the wedge usually faces forward so that the sea will drive it in tighter.

c. The final step is to place and tighten the cross battens. These battens help to secure tarps by acting as a hold-down against the top of the hatch.

d. Normally, the closing of the hatches by the longshoremen consists of replacing the hatch beams and hatch boards and spreading one tarpaulin over the hatch. The ship's crew will complete the battening down.

CHAPTER 9

LOADING WITH SPECIAL EQUIPMENT

136. GENERAL

a. In most modern ports, wharf or floating cranes are provided to supplement the ship's cargo gear in the handling of heavy lifts or to assist in the handling of general cargo. The advantage of loading heavy lifts in excess of the capacity of ship's booms by floating or wharf booms is obvious; however, in many cases these cranes will not be available for discharging at an oversea area. The type of equipment that will be available should be ascertained before loading.

b. Although the ship must be self-discharging, these cranes are employed to advantage when they are used in lieu of the ship's heavy-lift general gear, thus permitting the regular gear to continue working. They may also be used to double up a hold in order to employ two gangs in expediting cargo handling.

137. USE OF CRANES

a. Floating Crane. This type of crane is provided where it would not be practical to install a large and expensive, heavy-lift crane at a wharf over which general cargo usually passes. A crane that can transfer heavy lifts between barges or piers and deep-sea vessels in any part of a harbor is of great service. Floating cranes are designed to load and unload cargo too heavy for the ship's gear or where no dock facilities are available. This type of crane is usually made fast to the outboard side of the ship, picks the cargo off the pier or lighter, and discharges it at a wharf or on the deck of a vessel (fig. 98). One of the main advantages of a floating crane over a dock crane is its mobility and flexibility of use. For further information, see TM 55–335.

b. Shore-Based Crane.

(1) Wharf or pier cranes are not generally used in United States ports for loading and discharging general cargo. On the other hand, in many foreign ports, especially European, this type of crane is predominant, because pier sheds or warehouses are usually placed at a distance from the quay side. Cranes can swing over this distance, while the ship's gear can not (fig. 99).

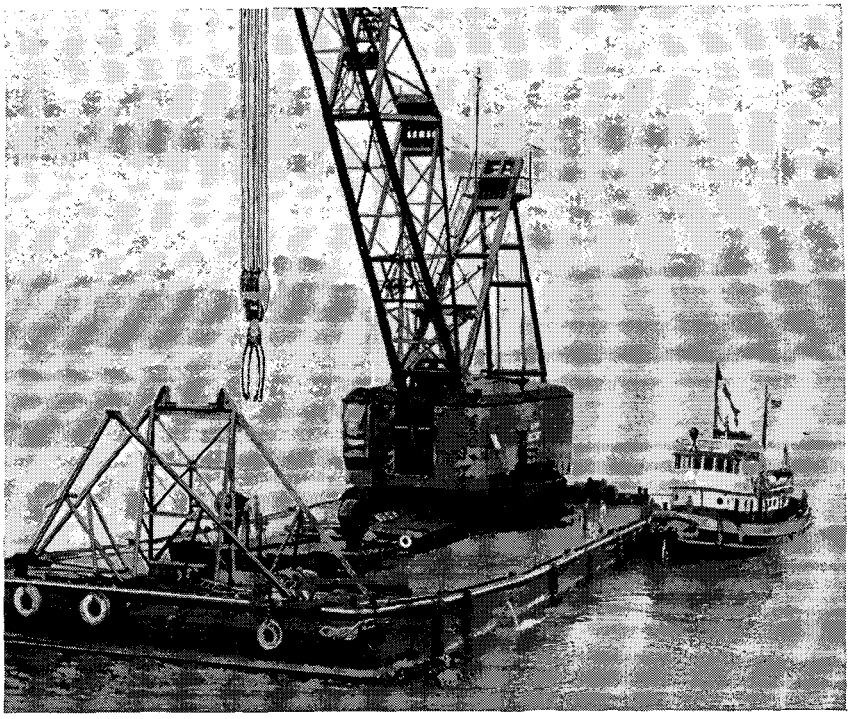


Figure 98. Floating crane, capacity 100 tons.

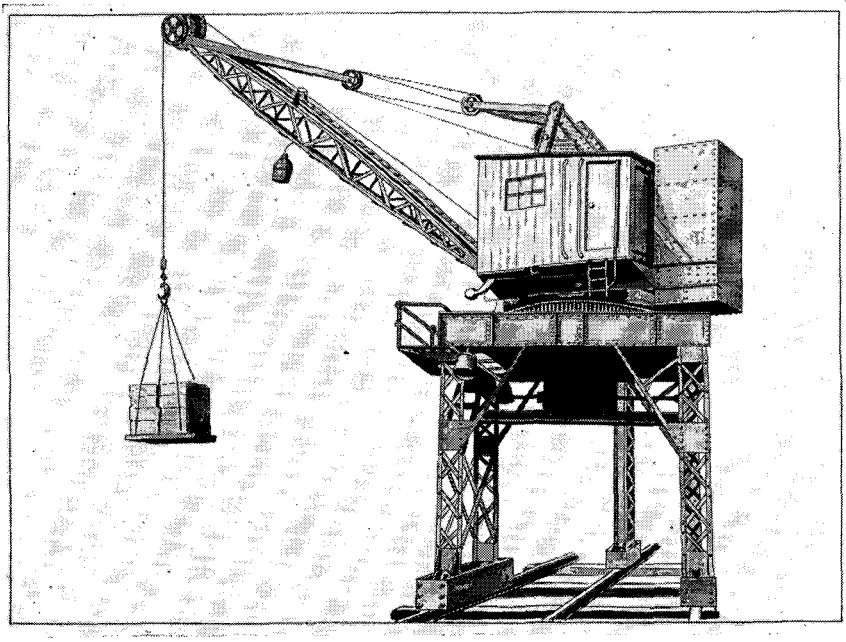


Figure 99. Gantry crane.

(2) Some advantages of the use of pier cranes are—

(*a*) They require fewer dockmen.

(*b*) They cover a wider area of deposit for the cargo, thus alleviating some of the congestion on the pier.

(*c*) Ship's rigging need not be used in their operation.

(3) Some disadvantages of this type of crane are—

(*a*) They are expensive to install.

(*b*) They must be used continuously to justify the installation.

CHAPTER 10

CARGO STOWAGE

Section I. PROPER STOWAGE

138. PURPOSE

The purpose of proper stowage is to load a vessel with cargo, taking into account the following factors:

a. Cargo must not be damaged by movement of the vessel while at sea.

b. Vessel must not be damaged nor personnel endangered by the cargo.

c. Best use must be made of the cargo space in order to utilize the maximum carrying capacity of the vessel.

d. Cargo must be able to be discharged with the greatest possible speed.

139. FUNDAMENTALS

a. Stowage of cargo in a hold may be compared to packing a foot locker or box. The idea is to pack as much into the box as possible; to pack it in such a way that it will not move during shipment; and to arrange the contents so that heavy items will not crush lighter ones.

b. Damage to cargo can be greatly minimized by employing a few simple rules of stowage:

(1) Cargo must be stowed so the strongest features of the construction of an item will bear the pressures and weights that item must sustain.

(2) Each item of cargo should be stowed so it will lend strength to the entire load.

(3) Dunnage must be used in proper quantities.

c. To insure the maximum utilization of the carrying capacity of a hold, broken stowage must be kept at a minimum. This can be accomplished by—

(1) Careful prestowage planning so that cases or boxes will fit into the hold and large vacancies will not occur.

(2) Proper supervision during loading to insure correct stowage and the fitting of irregularly shaped packages.

(3) Maximum use of filler cargo in spaces where tight stowage is possible (figs. 100 and 101).

Figure 100. Stowing boxed cargo around larger items of cargo to reduce lost space.

(4) Nesting of cargo to utilize otherwise wasted space (fig. 102).
(5) Avoidance of excess quantities of dunnage.
(6) Use of dunnage in constructing false decks to permit additional stowage (fig. 103).

Section II. DUNNAGING CARGO

140. DEFINITION OF DUNNAGE

Dunnage is any material—such as lumber, cordwood, paper, etc.—used to protect ship and cargo.

Figure 101. Using small boxes to fill in around the shaft in No. 5 lower hold.

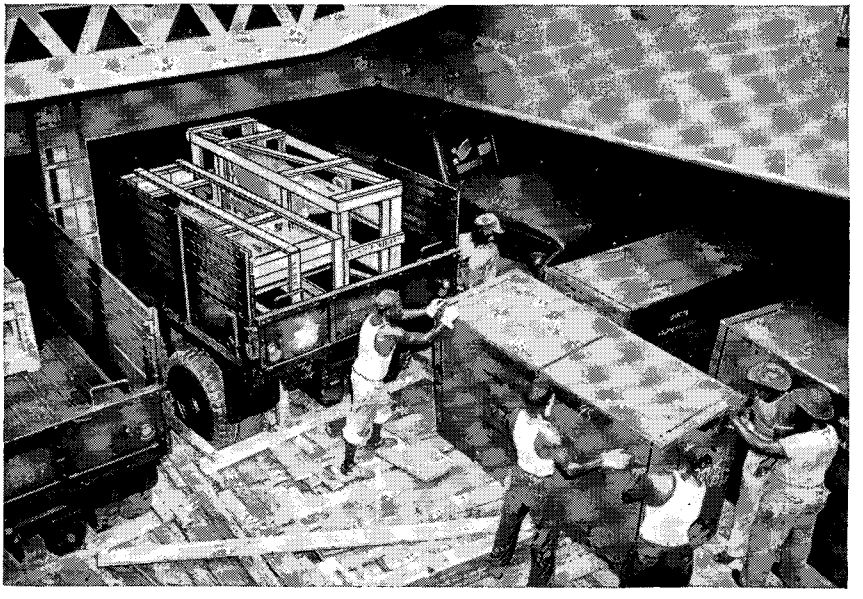


Figure 102. Cargo nested in the bed of a truck.

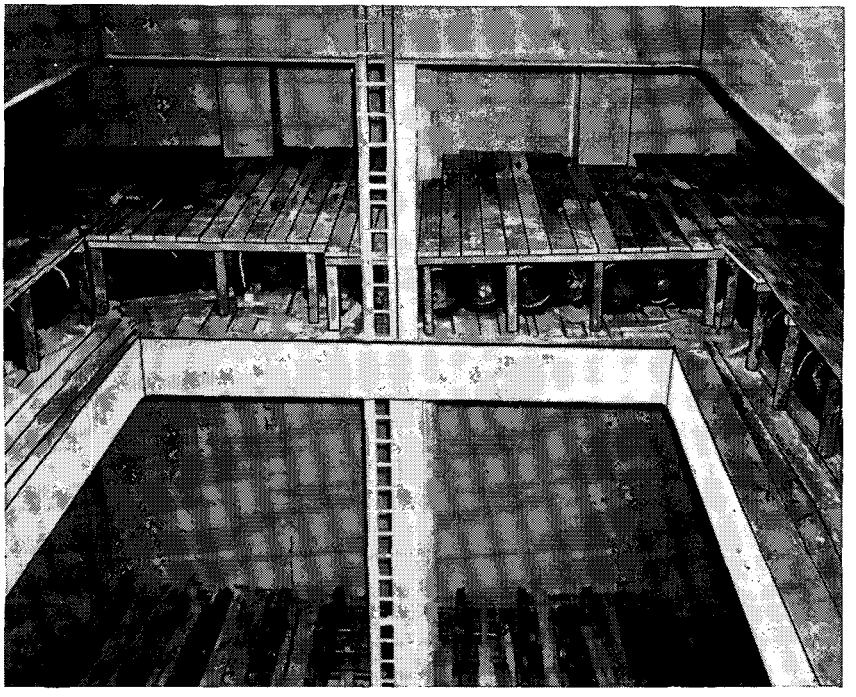


Figure 103. False deck built over car wheels to permit additional stowage of cargo.

141. USE OF DUNNAGE

a. Dunnage is an integral part of the process of stowing cargo. Because much cargo damage arises from improper dunnaging or lack of suitable dunnage, the general principles of good dunnaging should be understood by each member of the hatch section as well as by those in charge.

b. The main function of dunnage is to make the cargo an integral part of the ship. Dunnage is used for the following purposes, which vary in accordance with the type of cargo being carried:

(1) To prevent movement of cargo and chafing by chocking-off and securing containers and by filling in broken stowage or spaces which cannot be filled by cargo.

(2) To protect cargo from contact with water from overflowing bilges or double-bottom tanks, and from leakage from other cargo.

(3) To protect cargo from contact with moisture or sweat which condenses on the ship's sides and bulkheads and flows down to the waterway, finding its way to the bilges.

(4) To provide air courses for heated, moisture-laden air to reach the sides and bulkheads, along which it can rise toward the uptakes (figs. 104 and 105).

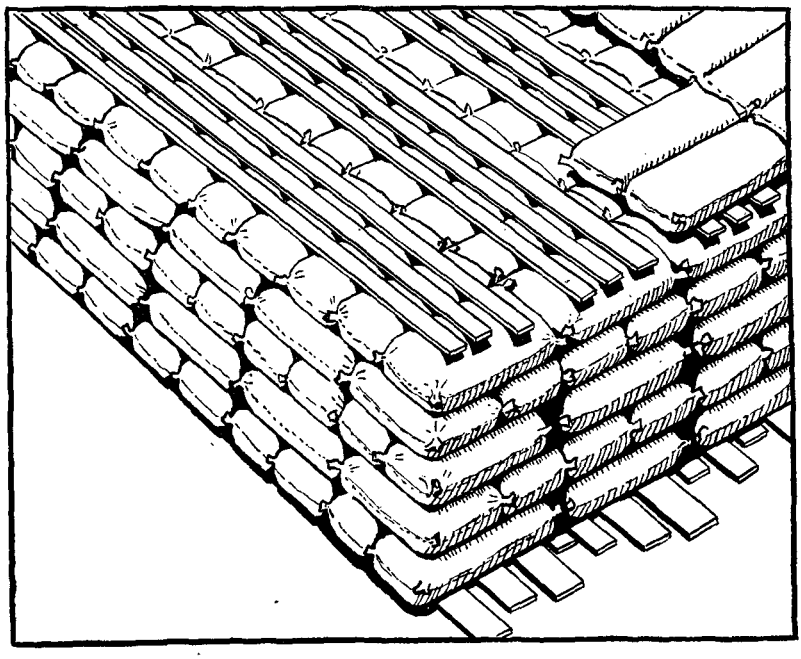


Figure 104. Dunnage used in stowing bagged cargo.

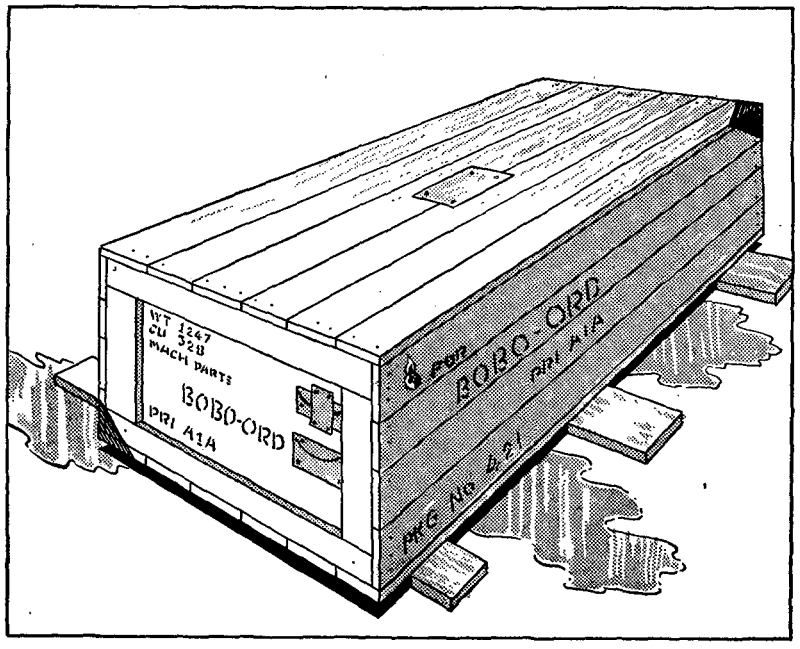


Figure 105. Dunnage used to protect cargo against moisture.

142. TYPES OF DUNNAGE

Ordinarily, the term dunnage refers to planks and pieces of wood; however, there are numerous other articles which can be used.

a. Rough Lumber. Rough lumber, 1 inch thick by 8 inches wide and from 12 feet in length, is the most desirable and the most common type of dunnage.

b. Cordwood. This type of dunnage is useful for stowing barrels, drums, and similar items.

c. Paper. This type of dunnage is used mainly for covering cargo to prevent damage from dust or dirt.

d. Miscellaneous. Numerous other materials may be used for dunnage, depending upon the availability of the material.

143. APPLICATION OF DUNNAGE

Hard and fast rules for dunnaging cargo are not possible because of the wide variety of cargo carried, differences in atmospheric conditions, availability of dunnage material, etc. However, certain basic considerations should be taken in every application of dunnage:

a. Dunnage should never be green or contaminated with a substance which might be harmful to the cargo.

b. Amount and kind of dunnage must be carefully selected to correspond to the type of cargo carried.

c. The bottom layer of dunnage must be laid to permit the flow of any water in the hold to the scuppers or drains. Depending upon the location of the drains in the cargo compartment, the first layer will be laid athwartship or fore and aft, and the next layer in the opposite direction. Cargo will be loaded on the second layer of dunnage.

Section III. SPECIAL CONSTRUCTION

144. GENERAL

The use of dunnage will not always meet the requirements for safety and damage protection. Special construction is required to secure and properly stow such items of supply as tanks, vehicles, cranes, fuel drums, ammunition, etc.

145. TYPES

a. Shoring. The supporting of objects by bracing them from below is known as shoring. This type of construction is used on decks for extremely heavy objects such as locomotives, tanks, etc. (fig. 106).

b. Bracing. The strengthening of an item by various methods is called bracing (fig. 107).

c. Tomming. The bracing of an item from above to hold it down is known as tomming. This method is used when a stowage space

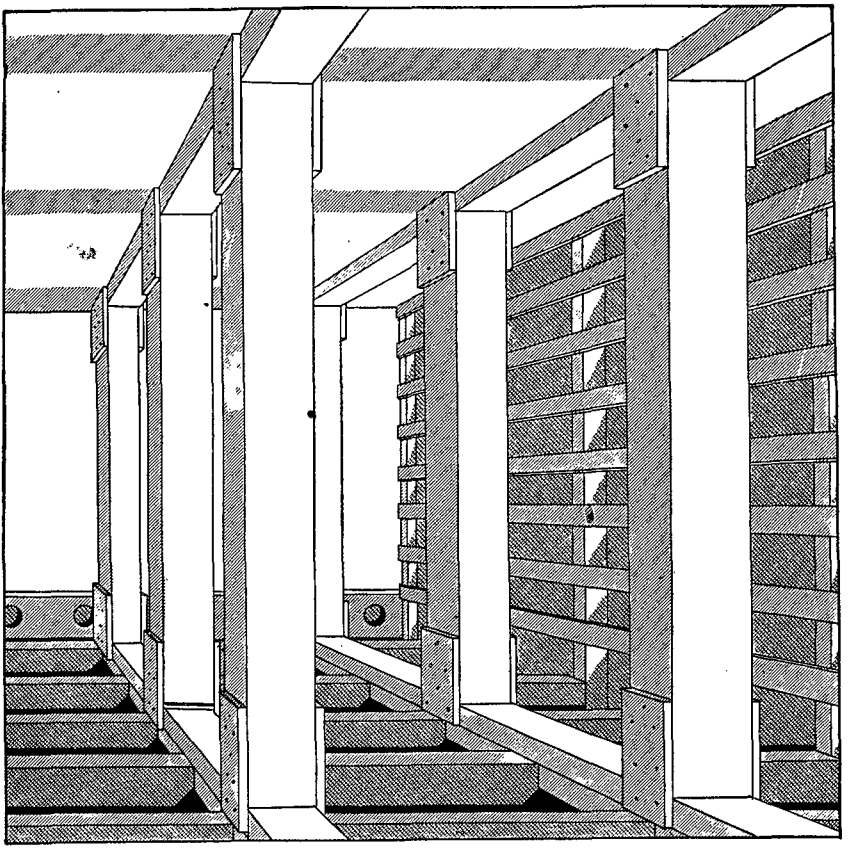


Figure 106. Shoring in 'tween deck.

has not been completely filled and there is danger that the vibration of the vessel might cause the cargo to shift (fig. 108).

d. Bulkheading. The segregating or partitioning off of a certain item by consignment of cargo to prevent its becoming mixed with other cargo is bulkheading. This is done by means of a wooden wall (fig. 109).

e. Cribbing. The use of dunnage to build up free space to properly secure cargo is known as cribbing (fig. 110).

f. Magazines. The containers constructed in the vessel's hold for the storage of ammunition and other military explosives are magazines. They are of two types—A and portable. Details on the construction of these magazines are contained in paragraph 177.

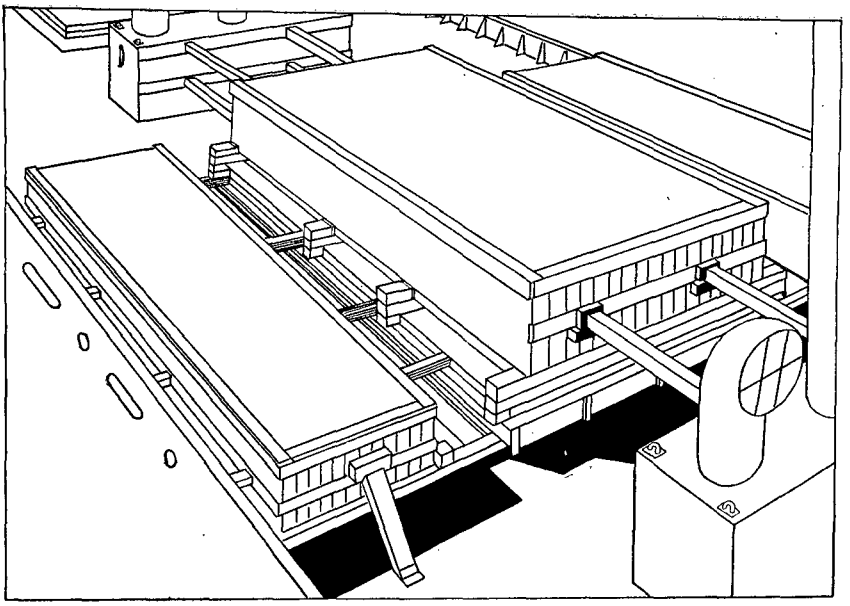


Figure 107. Bracing.

Figure 108. Tomming.

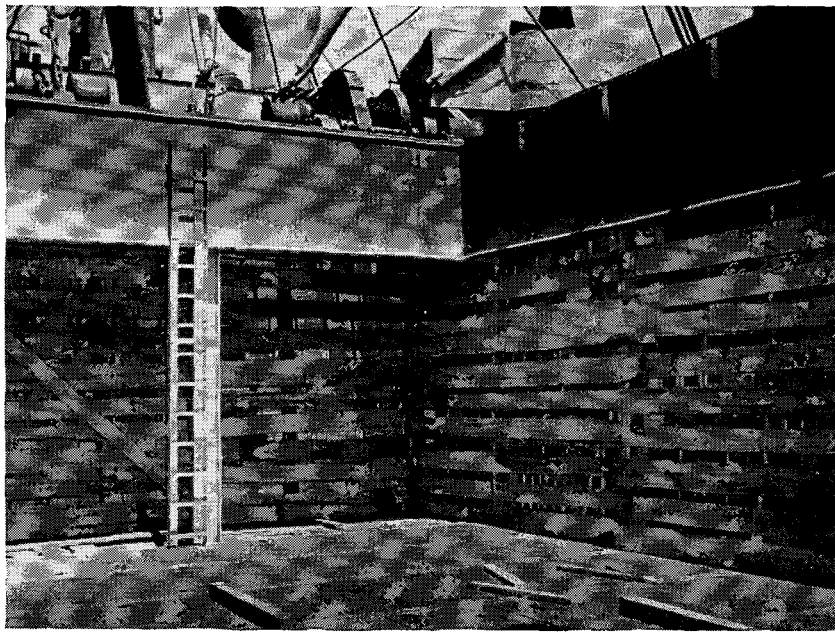


Figure 109. Bulkheading.

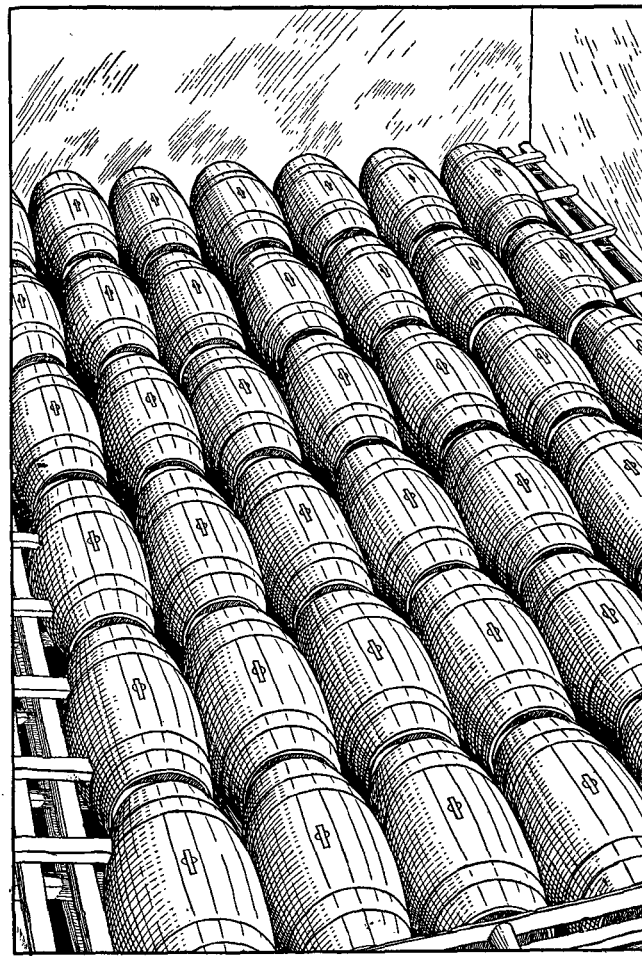


Figure 110. Cribbing first tier of barrels.

Section IV. LASHING CARGO

146. IMPORTANCE OF LASHING

a. At sea, certain forces exerted on cargo make it difficult for that cargo to remain stationary. In deck cargo, adequate resistance to such forces must be furnished by lashing to prevent shifting as the vessel rolls and pitches.

b. Lashing is important at all times but much more so when the master of a vessel sailing in convoy is not permitted to change course, speed, or heave to because of the weather. This adds to the hazards of exposed deck cargo and places a greater importance on the type and strength of the lashing.

147. FORCES ACTING ON CARGO

a. Forces which lashing must withstand are as follows:

(1) *Gravity force.* Gravity is the force exerted by the weight of the cargo itself and tends to pull the cargo straight down, regardless of the vessel's position.

(2) *Centrifugal force.* This force tends to pull the cargo upward.

(3) *Tangential force.* This is the force that tends to move the cargo sideways in the direction of the roll of the vessel.

b. General considerations in regard to forces are as follows:

(1) Those forces resulting from the pitching are comparatively small on modern cargo vessels.

(2) Forces created by the wind and sea are difficult to estimate.

(3) Since the maximum effect against the lashing is exerted at the farthest point of the vessel's roll and centrifugal force does not exist at that point, only the gravity and tangential forces need be considered.

(4) Sufficient lashing to secure against the gravity and tangential forces will suffice against any others.

c. The forces, therefore, which make lashing necessary are the gravity and tangential forces which combine to attempt to slide the cargo sideways during a roll (fig. 111).

148. BASIC LASHING PROCEDURE

a. The proper practice in lashing is to have all the component parts of a lashing of equal strength. Lashing applied where the wire rope used is double the value of the turnbuckle is a waste of wire rope, since the value of the turnbuckle will govern the tension that the lashing will bear.

b. Lashings which directly counteract the force to be met are the most desirable. Since the force to be met is largely horizontal, the

Figure 111. Cargo damage resulting from improper securing against athwartship forces.

angle of the lashing should be as near to the horizontal as possible. This angle will vary with the size of the item of cargo and the obstructions on deck.

c. There are three general ways to lash an item of cargo on deck:

(1) A lashing passed over the top of the case only is the least desirable, as it is more effective for opposing the almost nonexistent upward (centrifugal) forces than for offsetting the horizontal forces.

(2) A lashing passed completely around the item provides greater resistance to the athwartship forces, even though additional lashing material is required.

(3) A combination of one of the above methods with hatch clamps at each corner is another desirable method.

(*a*) This method provides an effective resistance to all forces.

(*b*) The substitution of iron rods for wire rope provides additional security for the cargo.

149. LASHING MATERIAL

a. Lashings should be of a type which can be applied and removed quickly.

b. Choice of lashing materials is governed by their availability and the type of cargo to be secured.

(1) Manila rope is seldom used except for light and small cargo items.

(2) Wire rope is used most frequently for heavy and large cargo. Five-eighths-inch wire is the most commonly used.

(3) Chain is used satisfactorily when available.

(4) Steel or wrought iron rods are exceptionally advantageous on boxed or rectangular cargo.

(5) Straps and hand-type lashings are used when only a short lashing is needed.

(6) Turnbuckles should be used with all types of lashings to permit tightening en route.

150. PRECAUTIONS IN LASHING

a. Protection of Cargo.

(1) Dunnage or metal strips should be placed between the cargo and the lashing to prevent the lashing from cutting into the item.

(2) Because of the compression exerted by the lashing on the cargo, extra bracing may be necessary to prevent the cargo from being crushed.

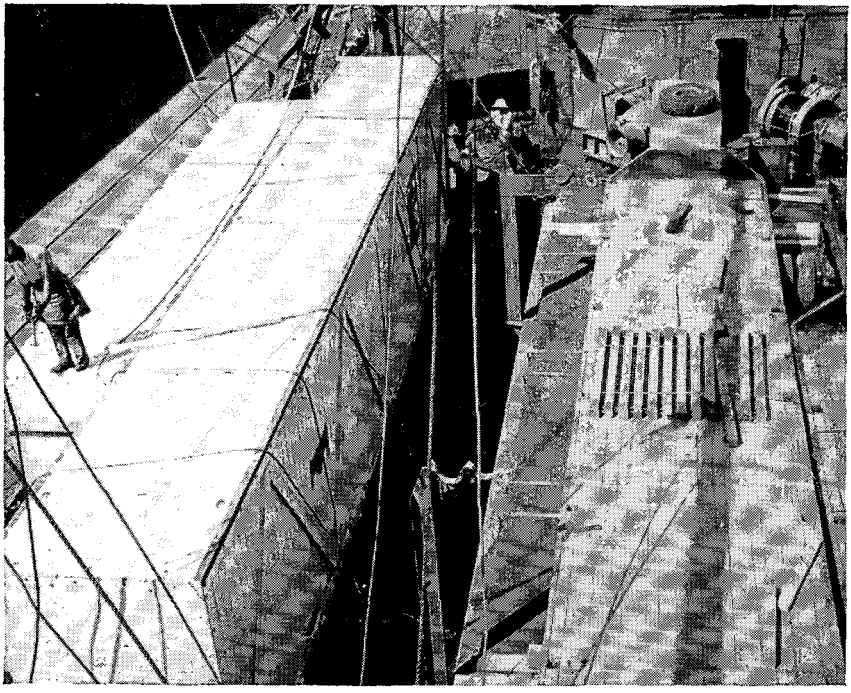


Figure 112. Large box secured on deck by one continuous lashing.

b. Lashing Practices To Be Avoided. Avoid use of a continuous length of wire rope for lashing. If the rope is broken at any point, the entire lashing will be useless. One continuous lashing is just *one* lashing, no matter how many times it is wound around the item (fig. 112).

Section V. STOWING SMALL BOXES AND MAIL

151. SMALL BOXES

a. Each tier of small boxes of similar size and shape should be kept as level as possible.

b. Each box should rest on two boxes beneath it to distribute the weight.

c. Dunnage should be placed between tiers whenever necessary to distribute the weight.

d. A box should never be placed so that it rests directly on top and inside the four corners of the box beneath it.

152. MAIL

a. Mail must be stowed so that it can be discharged before any other cargo. For this reason it is usually stowed in the mail locker or in the square of a forward hatch.

b. In stowing mail, consideration must be given to security against pilferage and protection against water and dampness.

Section VI. STOWING BAGGED CARGO

153. PROTECTION FROM MOISTURE

Many commodities carried in bags are subject to damage if stowed close to moist cargo or cargo that may sweat; care must be taken to protect each bag against direct contact with iron work. Special precaution should be taken at the turn of the bilge, brackets and tank taps, and all places where moisture is likely to occur. Mats or other protective material should be used to provide protection against moisture running down the beam hold stanchions, etc. When loading bagged cargo aboard a vessel on which only wooden cargo battens are used for dunnage, the bags in the wings should be stowed on end to prevent the centers from protruding over the battens and coming in contact with moist metal and hull platings.

154. PROTECTION FROM CUTTING

Bags should not be allowed to overlap beams, stringer plates, or similar obstructions in the hold, because the working of the vessel is likely to cause the bags to be cut. Vertical dunnage placed against ladders and hatch battens will prevent bags from being cut or from falling. The use of cargo hooks should not be tolerated in handling bagged cargo.

155. METHODS OF STOWAGE

a. Bagged cargo in large lots is stowed in tiers across the hold. There are three general methods for stowing bagged cargo—the full-bag, half-bag, and cross-tier methods.

(1) Full-bag (fig. 113) provides all possible ventilation for commodity.

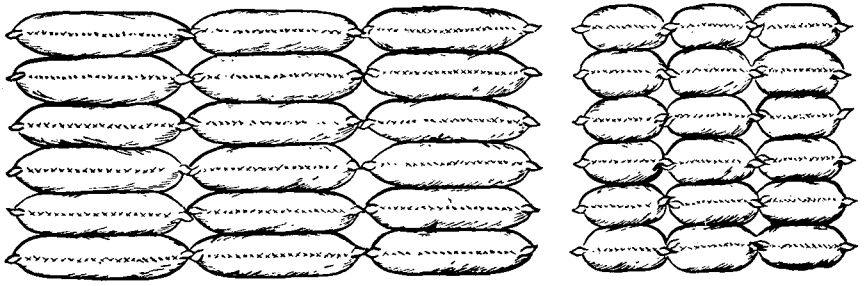


Figure 113. Full-bag method of stowing bagged cargo.

Figure 114. Half-bag method of stowing.

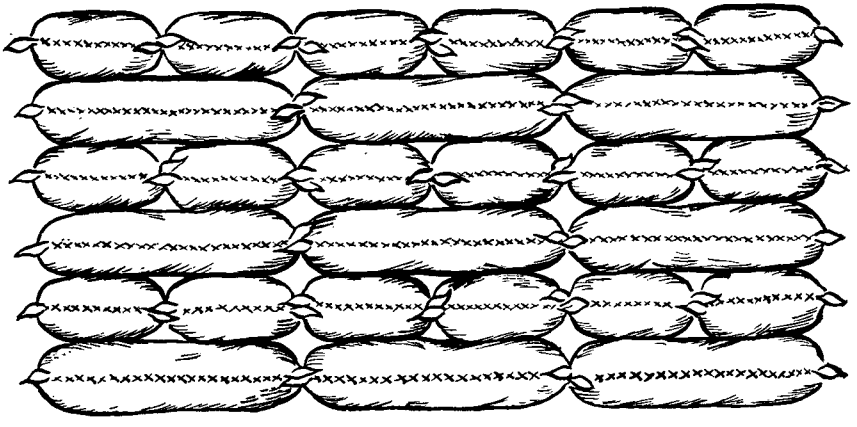


Figure 115. Cross-tiering of bags.

Figure 116. Typical stowage of bagged cargo.

(2) Half-bag (fig. 114) is used where floor ventilation is not important and bags are soft.

(3) Cross-tier (fig. 115) is used to prevent collapsing by blocking corners and several outer rows.

b. Figure 116 illustrates a typical stowage of bagged cargo. Note dunnage around the ladder to protect bags, bulkhead to prevent shifting, and cross-tier method of stowing.

Section VII. STOWING BALED CARGO

156. PROTECTION FROM CHAFING

Baled cargo is especially liable to damage by chafing.

a. To prevent chafing, baled cargo should be carefully dunnaged and blocked off, eliminating movement of the cargo.

b. Flat-board dunnage should be used underneath bales since dunnage with sharp edges would cut through the bale wrappings.

157. PROTECTION FROM MOISTURE

Baled cargo should also be protected against damage from moisture.

a. All metal parts in the hold should be dunnaged in a way which will prevent damage from moisture.

b. Bales at the side of the hold are frequently stowed on end to present the least surface, in the event that moisture condenses on the sides of the ship or chafing damages the bale.

c. Bales may be stained by oil left on deck or ceiling or by leakage from other cargo stowed above.

Section VIII. STOWING OF BARRELS AND DRUMS

158. GENERAL

a. There are two types of barrel cargo—wet-barrel cargo and dry-barrel cargo. Olives, wine, and vinegar are examples of wet-barrel cargo; and flour, sugar, and powdered milk, dry-barrel cargo.

b. For a full hatch of wet barrels, the bilge and cantline method of stowage is preferred. To understand this method of stowage, one should first be familiar with the construction of a barrel (fig. 117). The correctly constructed barrel has the bung stave, rivets in hoops, and head staves all in line. The quarter is the strongest part of the barrel; the bilge is the weakest.

159. METHODS OF STOWING WET BARRELS (BILGE AND CANTLINE)

a. The first row of barrels is placed with a chime against a dunnaged bulkhead, starting at the center of the ship and working toward the wings (fig. 118).

(1) The first tier should be cribbed in each wing and against one bulkhead (fig. 110).

(2) All bungs must be up to prevent leaking.

(3) Quoins, made of wood approximately 2 by 2 by 14 inches, or suitable substitutes, are placed under each quarter to raise the bilge free of the deck.

(4) The first row acts as a key for each succeeding row.

b. Before receiving barrels for the second tier, a loading platform of 1-inch dunnage may be laid in the square of the hatch against the first tier to facilitate rolling the barrels.

c. The barrels on the second tier are loaded in the cantline of the first tier.

(1) The cantline is the cradle formed by the quarters of four barrels.

(2) The cribbing along the bulkhead shifts to the opposite end of the hatch in the second tier.

d. The third tier and each succeeding tier is stowed in the same manner as the second tier.

160. METHOD OF STOWING DRY OR SLACK BARRELS (fig. 119)

Slack barrels containing glassware are commonly stowed completely on their ends. Care must be taken to see that they are on a level

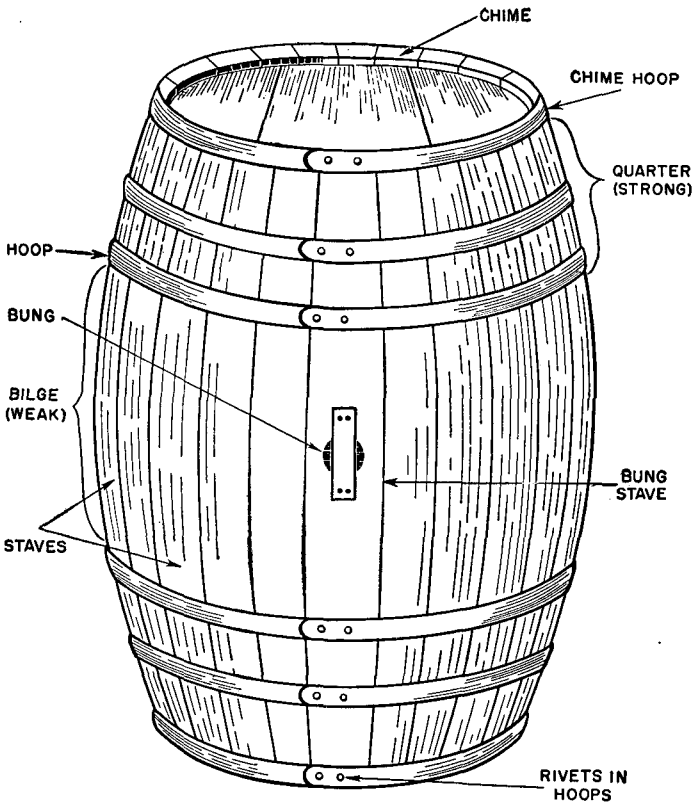


Figure 117. Nomenclature of barrel.

foundation, and strong dunnage must be placed on each tier. Only extremely light cargo should be stowed on top of such barrels.

161. METHOD OF STOWING DRUMS

a. General. Drums are usually made of steel and are stowed with the bungs up. Since the bungs are normally on the top, the drums will be stowed upright.

b. Preparation of The Hold.

(1) Lay dunnage on the deck approximately 6 inches apart; drums will be placed on this dunnage.

(2) Build a shelf over bilge, as shown in figure 120, or use cordwood for cribbing, as shown in figure 121.

(3) Place dunnage between the first row of drums and the bulkhead.

c. Stowing of First Tier.

(1) Work from wings to center of hold.

(2) Rest chime squarely on the dunnage.

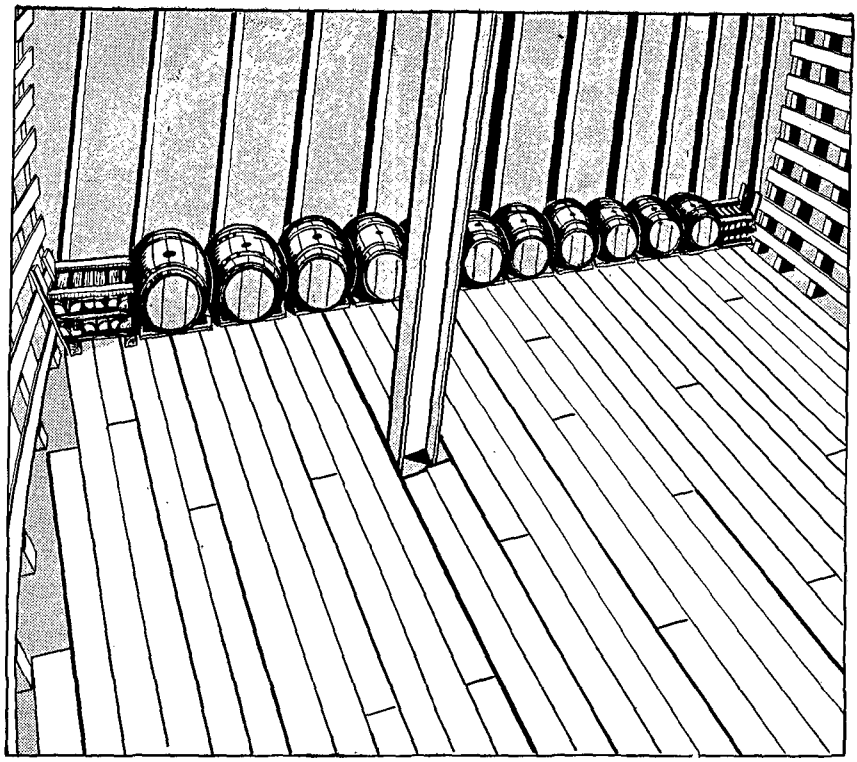


Figure 118. First row of barrels.

Figure 119. Stowage of dry barrels.

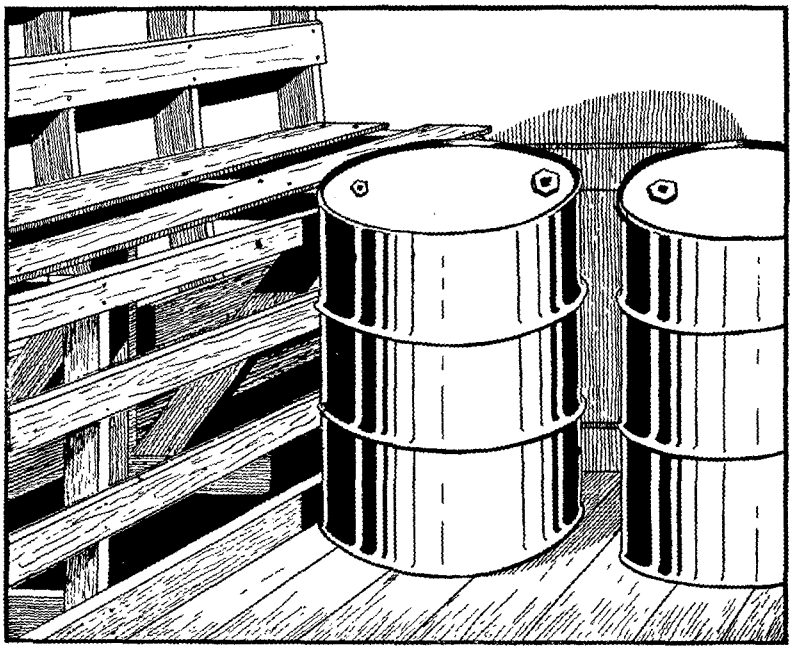


Figure 120. Make-up of bilge by making a shelf.

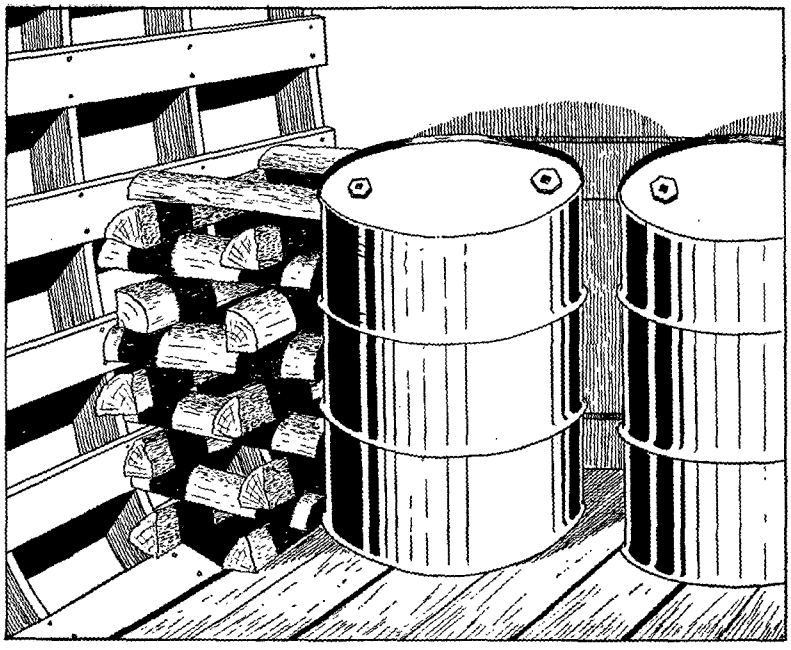


Figure 121. Make-up of bilge by use of cordwood.

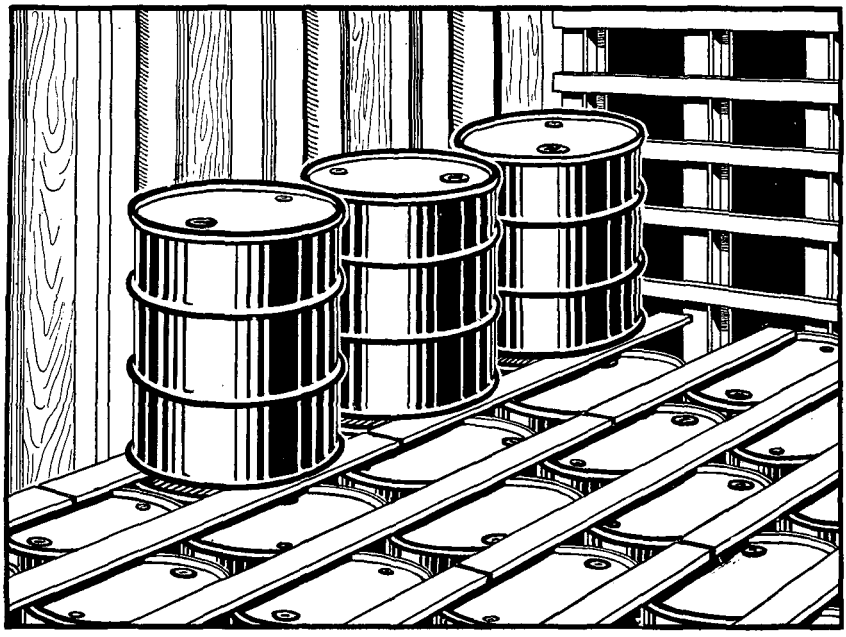


Figure 122. Use of dunnage in stowing drums.

(3) If this row does not fit securely across the bulkhead, save space by spreading out the drums and placing the second row deeper in the centerline of the first.

d. Stowing of Second Tier.

(1) Lay dunnage over the first tier.
(2) Place drums on dunnage, as shown in figure 122.
(3) Stow succeeding tiers in like manner.

Section IX. STOWING OF VEHICLES, WHEELED OR TRACKED, SET UP

162. METHODS OF STOWING

a. Procedure for Stowing Vehicles.

(1) While man steers, roll vehicle into place (fig. 123).
(2) A rolling car jack may be used to cut either end around.
(3) Place vehicles fore and aft.
(4) Stow vehicles far enough apart to prevent their rubbing against each other.

b. Procedure for Securing Vehicles.

(1) Chock wheels on all four sides so that the vehicle cannot move in any direction. The size and type of the vehicle will dictate the size lumber to use.

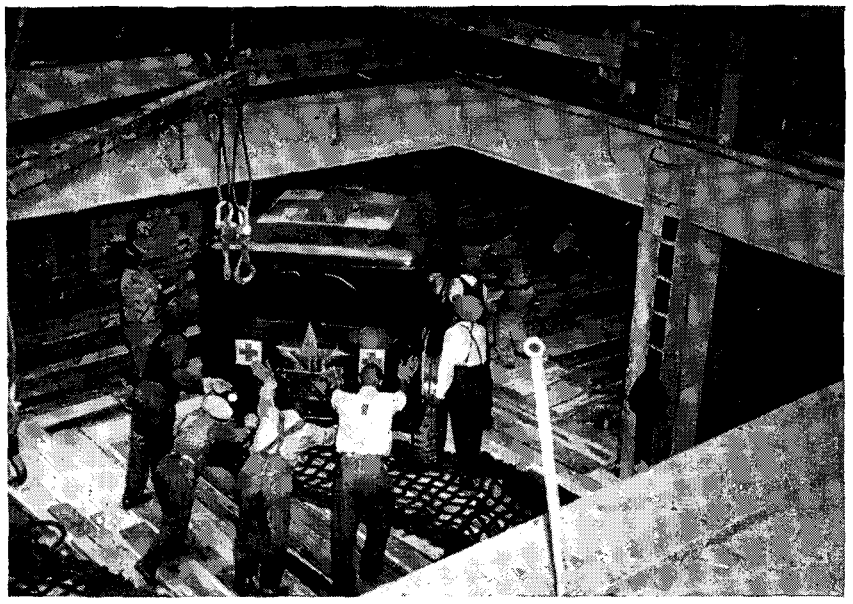


Figure 123. Moving vehicle to place of stowage by rolling while man steers.

(2) Brace individual vehicles to bulkheads, stanchions, or other vehicle chocks.

(3) Lash the vehicle with wire rope, and block under springs to prevent side sway.

c. Procedure for Stowing Tanks.

(1) All tanks stowed below deck must be stowed in gear, with the brakes on, and in fore and aft position.

(2) When tanks are stowed on top of cargo such as steel or slabs of metal, a solid floor of not less than 2-inch planking must be constructed before loading. This floor must be nailed down. When tanks are stowed in 'tween decks, a similar floor should be laid.

(3) When tanks are stowed on the floor of a hold, a false deck should be constructed so that all cubic space in the hold may be utilized. This false deck must be solidly constructed and must not rest on any part of the tank.

(4) Tanks under 18 tons should be secured by at least 4- by 6-inch lumber, and those 18 tons and over should be secured by at least 6- by 8-inch lumber (fig. 124).

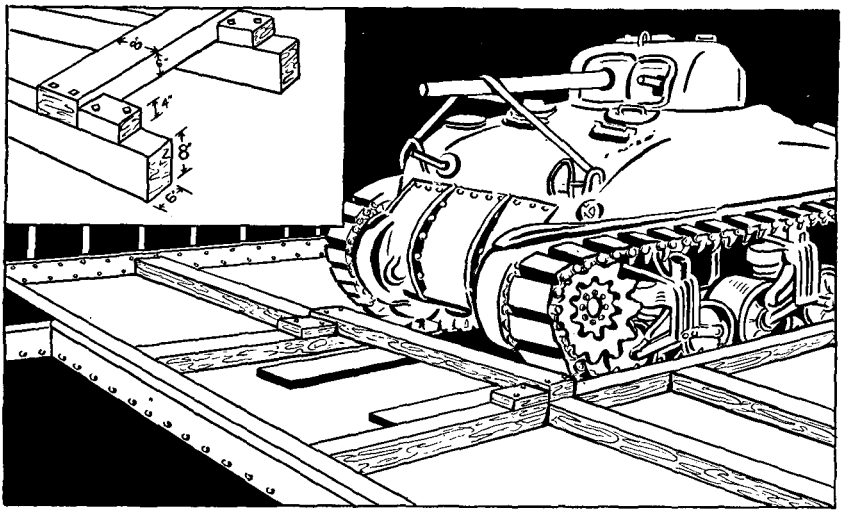


Figure 124. Chocking of tank below deck.

Section X. STOWING OF LARGE, HEAVY BOXES AND CRATES

163. METHODS OF STOWING

The main problem in stowing cargo of this type is the moving of the item from the square of the hatch to the place of stowage. This can be accomplished by several methods:

a. Landing the case or box on rollers (fig. 125).

b. Landing the case or box on a truck made of greased or soaped dunnage.

c. Using a dragline. For further information on this method, see paragraph 164.

164. DRAGLINE

a. Heavy boxes, vehicles, tanks, or other cargo which, because of its size, cannot be moved from the square of the hatch to the place of stowage by hand must be moved by means of a dragline.

b. The dragline operation changes the direction of pull from the vertical pull of normal cargo operations to a horizontal pull required to move the cargo to any point in the hold.

c. This change in direction is accomplished by the use of snatch blocks and is set up in the following manner:

(1) Land the item to be dragged on rollers or on soaped or greased dunnage to facilitate moving and to reduce the strain on the gear.

(2) Attach a snatch block at the desired stowage location to give the proper direction to the pull.

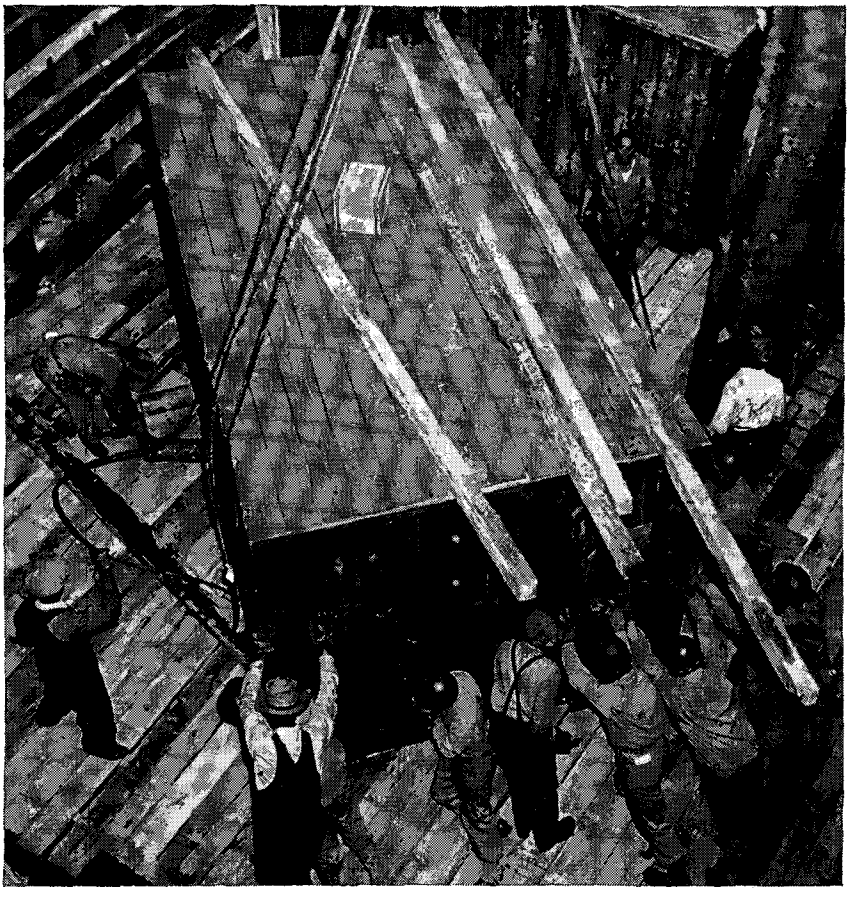


Figure 125. Moving large case by means of rollers.

(*a*) Leads on which the snatch blocks are hung should be made of chain or wire rope.

(*b*) Dunnage should be placed around stanchions where the leads are made fast to permit cutting of the lead.

(3) Attach a dragline to the case through the snatch blocks (fig. 126).

(*a*) The dragline should be made of wire rope in preference to manila or sisal.

(*b*) The dragline should be made fast directly through the heel block to the winch, thus eliminating any strain on the topping lift and boom.

(*c*) The dragline must be clear and must not rub or chafe at any point. Additional snatch blocks can be used to provide fairleads for the dragline.

(4) In order to cut down or eliminate work stoppage while drag-

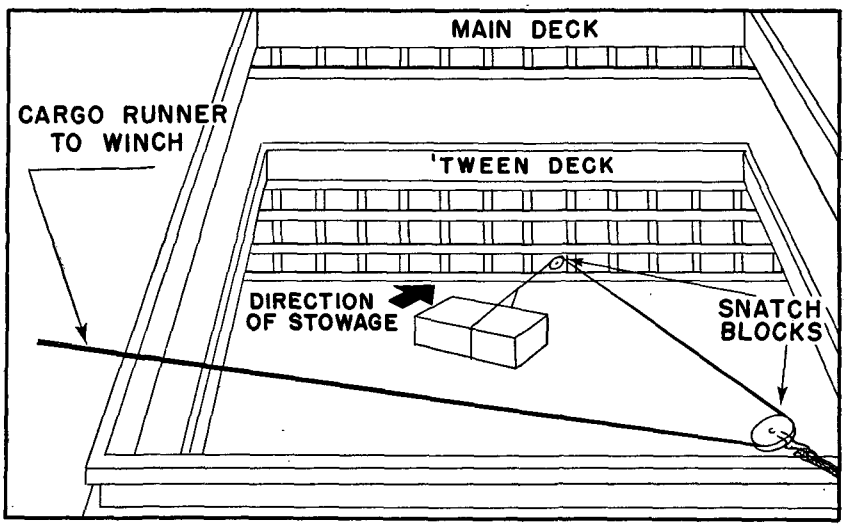
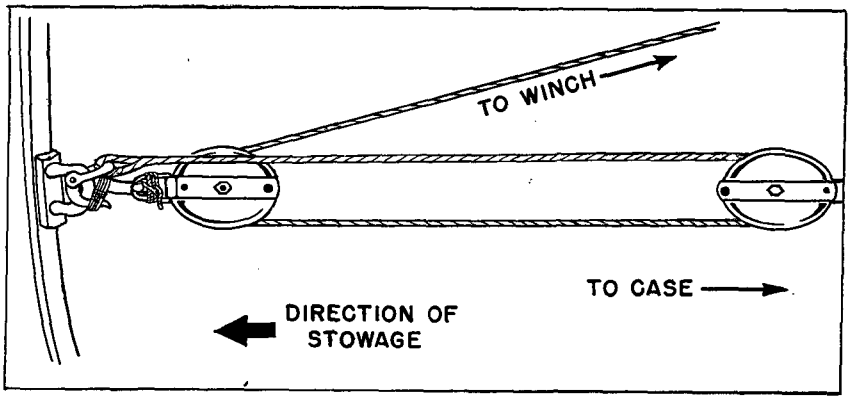


Figure 126. Dragline.



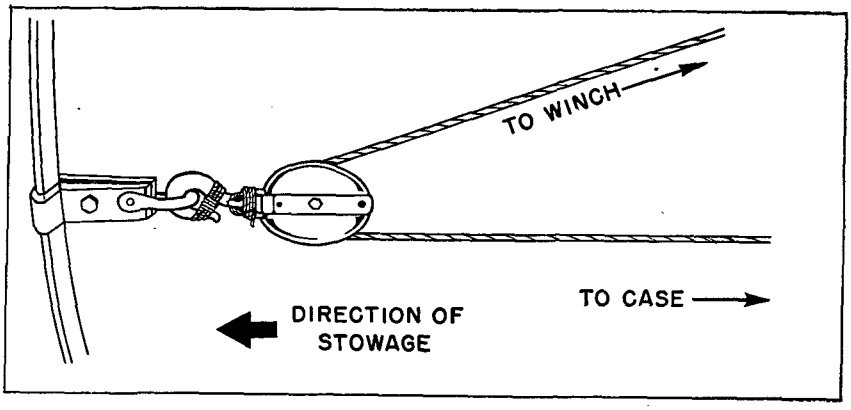


Figure 127. Use of tackle with a dragline.

line operations are in progress, observe the following procedure:

(*a*) Avoid using cargo fall and ship's boom for dragline operations.

(*b*) Have dragline rigged and ready for use.

(*c*) Avoid using winches at hatch for dragline use. If possible, use the warping winch, anchor windlass, or winch at another hatch.

(*d*) Use two draglines when discharging or loading with a crane.

(5) If the case is too heavy for the winch to pull, use a tackle (fig. 127). If necessary, improvise a tackle by using additional snatch blocks. Keep men out of the bight of the line at all times. On heavy items, it is preferable to use two draglines.

Section XI. PILING AND LONG ITEMS OF CARGO

165. DISCHARGING

a. Long timbers, piling, steel rails, etc., stowed on deck present a problem in discharging because of their location in relation to the position of the cargo hook (fig. 128). By use of a drag fall and a

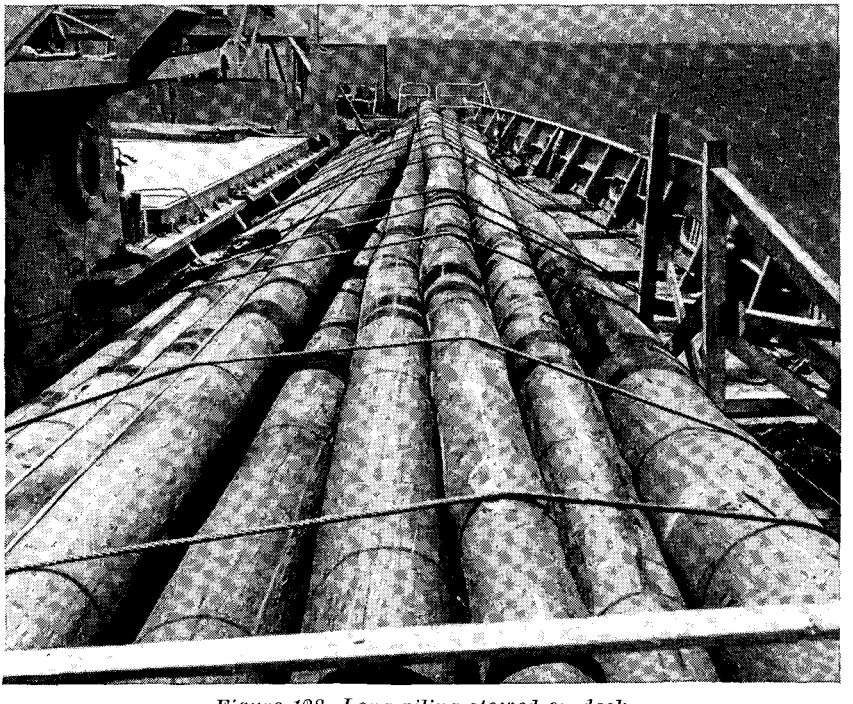


Figure 128. Long piling stowed on deck.

TIPPING ANGLE

DETERMINING TIPPING ANGLE NECESSARY WHEN PIECE EXCEEDS THE LENGTH OF THE HATCH

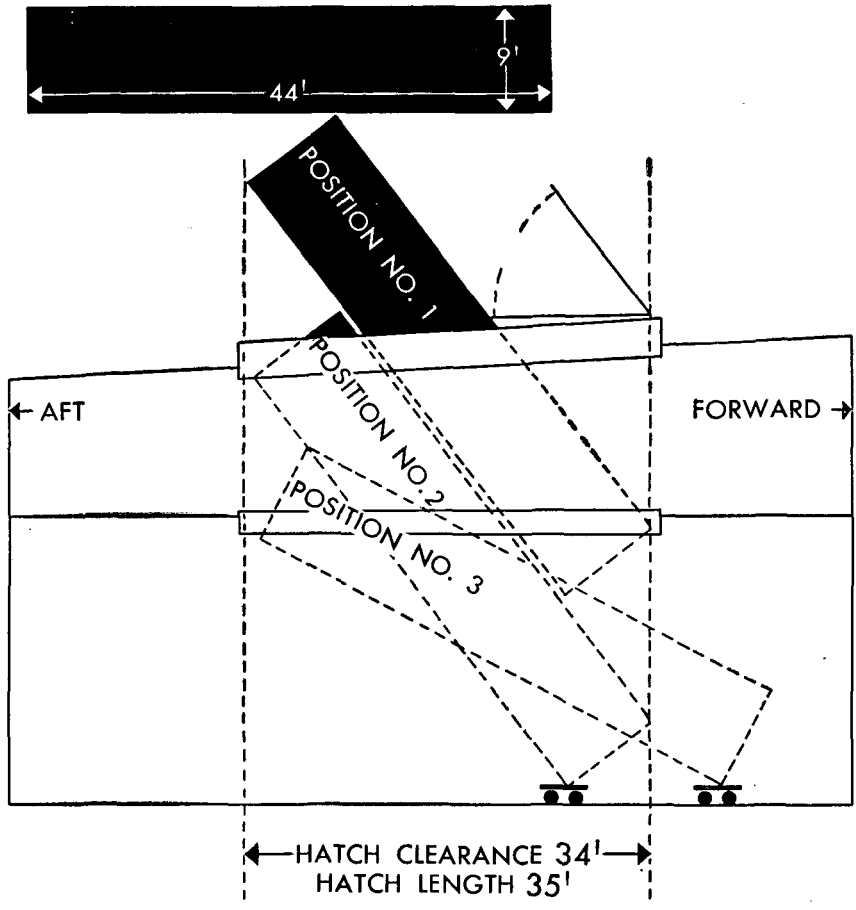


Figure 129. Tipping angle.

snatch block, the long lengths can be placed in position for hoisting and maneuvering.

b. The following is one method of discharge:

(1) The long items are moved along the deck by a drag fall until the appropriate part is under the cargo hook.

(2) A sling is passed around the draft and the draft hoisted approximately 5 feet.

(3) The end toward the winch is swung around to the opposite side of the deck by use of a tag line.

(4) The item is then swung out over the rail and lowered over the side of the ship.

c. Where a gun tub, shrouds, or other obstructions do not permit use of the above method, it may be necessary to sling the drafts several times. Excessive strain on the cargo gear may result, unless consideration is given to the handling method used.

166. TIPPING ANGLE

a. When long items of cargo must be stowed below deck, and the length of the item exceeds the maximum width of the hatch opening, the following method should be employed to determine the angle required (fig. 129):

(1) Construct a model of the case and the hatch opening to scale. These may be made of wood, paper, or any other satisfactory material.

(2) Using the models, tip the case until it fits into the hatch opening.

b. This method is advantageous, because it will—

(1) Save man-hours by determining in advance whether the cargo will go under deck.

(2) Provide the angle at which it must be tipped.

(3) Indicate the place where the sling must be located.

(4) Show whether a sling placed as shown will hold the item (fig. 129).

Section XII. STOWING BULK COMMODITIES

167. GENERAL

Stowing of such bulk items as grain, coal, ore, etc, will be rare for Army longshoremen, and only general rules are mentioned in this section.

168. GRAIN

a. Grain is a difficult cargo to carry aboard ship. It may shift and give the vessel a dangerous list or it may swell, if shipped green or damp, and seriously strain the vessel.

b. The most important part of stowing bulk grain is to see that every hold is properly trimmed. Portable wooden partitions or "shifting boards," running fore and aft are required by law to keep the grain from shifting.

c. Compartments must be absolutely dry and dampness of any kind kept out. Proper ventilation is a primary consideration in carrying cargo of this type.

d. Where bulk grain does not completely fill the cargo space, the

hatch must be topped off with bagged grain or secured by some other method. As all grain will settle during a voyage, dunnage must be laid over the top to prevent the bagged grain from sinking into the bulk cargo.

e. As grain dust is inflammable to an explosive degree, precautions must be taken to prevent the use of naked lights so that sparks will not enter the hold. The compartments should be thoroughly ventilated before allowing longshoremen to enter to prevent possible asphyxiation.

169. METHOD OF STOWING COAL

a. Coal is generally carried in bulk and certain precautions in stowing should be observed to reduce the danger of spontaneous combustion and the possibility of the coal's shifting or clogging the ship's pumps.

(1) The first coal loaded in a ship should not be broken, as coal that has been recently broken is more likely to ignite spontaneously.

(2) Provision should be made for the temperatures to be taken at the bottom of each hold and at the end of each hold so that any undue rise in temperature can be detected at once.

(3) Wet coal is no more likely to cause spontaneous combustion than dry coal.

b. It is advisable to put as much coal as possible in the center hatches and then to load a certain amount in the end hatches.

(1) While the center hatches are being leveled off, the end hatches should be completed and the vessel trimmed to its load line by the end hatches.

(2) If a hold is not completely filled, it is advisable to lay several layers of dunnage on top of the hold to minimize the possibility of shifting.

Section XIII. STOWAGE OF PERISHABLE CARGO

170. TYPES

Perishable cargo is divided into three general classes:

a. Frozen cargo is that type of perishable which is transported at temperatures ranging from approximately 0° to 32° F. Such foods as meat, fish, butter, and poultry are classified as frozen cargo.

b. Chilled cargo is transported at temperatures ranging from 33° to approximately 60° F., depending upon the commodity, and includes such items as eggs and fresh vegetables.

c. Air-cooled cargo consists mainly of fresh fruits. On long voyages or in tropical climates, this type of refrigerated cargo is carried

as chilled cargo. For the purposes of military stevedoring, only frozen and chilled cargo are considered.

171. GENERAL

a. In general, stowage of refrigerated cargo does not differ greatly from that of general cargo, except that this type of cargo requires more consideration regarding temperature and ventilation.

b. In planning for the stowage, foods having a strong odor must be separated from those having a tendency to absorb such odors.

c. All cargo compartments must be at the prescribed temperature before loading to prevent the refrigerated cargo from thawing.

172. FROZEN CARGO STOWAGE

The most common types of frozen cargo which may be encountered are discussed in *a* through *f* below.

a. Quarters of beef are shipped at temperatures of 12° to 15° F. and are usually wrapped in hessian cloth. These are customarily stowed fore and aft on edge. If stowed flat, circulation of air is impeded. Forequarters and hindquarters cannot be stowed well together; usually they are stowed at different ends of a compartment. Quarters may be stowed as high as stevedores can reach. Those stowed in the center of the hatch should be covered with a clean canvas, and dunnage for stevedores to walk and land cargo on should be laid. If the quarters are overstowed with cargo, 3- by 3-inch battens should be laid on the beef. These battens should be frozen before use or the meat will become marked. In a hold completely filled with beef, battens are not necessary as the irregular shape of the quarters permits the free circulation of air.

b. Fish is shipped in boxes in a hard-frozen condition at temperatures of 20° F. or lower. This type of cargo should be stowed in a separate hold to avoid tainting other food. Cases should be stowed fore and aft athwartship battens, spaced to support the cases.

c. Butter, which is usually shipped in boxes or cases, may be stowed with meat, but it should not be stowed with fruit as it will absorb the taint of that commodity. Butter is hard-frozen cargo and can be carried at 20° F. or lower. The loading temperature should never be higher than 30° F. Battens must be used to separate the boxes and permit the complete circulation of air.

d. Mutton and lamb carcasses are shipped in a hard-frozen condition with temperatures from 10° to 15° F. Canvas slings should be used for handling. This cargo, when hard-frozen, is brittle and should be handled carefully. Carcasses should be stowed fore and aft and back to front for easier stowage. Three- by three-inch frozen battens should be used in such a way to permit the circulation of air.

This cargo is light and should not be overstowed with heavier items.

e. Pork carcasses are shipped hard-frozen at a temperature ranging from 10° to 15° F. Stowage is the same as for mutton.

f. Poultry is handled at temperatures of 20° F. or lower.

173. CHILLED CARGO STOWAGE

a. Chilled beef is usually stowed at 28° or 29° F. This type of cargo is hung from hooks attached to the deck above. The quarters should be packed close enough together to prevent swinging but not close enough to interfere with the air circulation.

b. Cheese is transported usually in wooden cases at a temperature range of 35° to 40° F. Under certain conditions, cheese gives off poisonous fumes, and these fumes should be cleared before men are allowed to enter compartment. Cheese is also subject to taint.

c. Fresh vegetables and fruits are carried at temperatures ranging from 34° to 40° F. This cargo should be stowed and dunnaged to permit the free circulation of air.

174. CIRCULATING AIR CHAMBERS

a. The most important factor to consider when transporting fresh fruit is ventilation. Much fresh fruit is carried without refrigeration on short voyages. If picked at the right time, fruit may be carried with only natural ventilation; however, a mechanical system consisting of circulating air is more satisfactory.

b. A mechanical system depends as much on the complete circulation of air as it does on refrigeration. It consists generally of intake and exhaust fans and air coolers situated throughout the hold. The air is cooled by the fans and kept circulating through the chambers. A certain amount of fresh air is taken into each chamber and a like amount of air in the chamber is expelled into the outside atmosphere to reduce the carbonic content of the chambers.

c. Cargo which is likely to taint other cargo or which readily absorbs the taint of other commodities must be kept in separate and distinct cooling systems.

175. LOADING

a. Of all the types of cargo loaded, refrigerated cargo is the most difficult to handle because of the high degree of spoilage resulting from rough handling, inclement weather, and delays in loading:

(1) Speed is the essential factor in the loading of refrigerated cargo. This requires careful planning so that commodities will not remain out of refrigeration too long.

(2) Damage to the cargo resulting from exposure to rain, handling which has caused bruising, or delays in loading which

have caused temporary thawing is not immediately apparent to the loading authorities. However, any damage will become apparent at destination and may result in the forced issue or destruction of the entire cargo.

(3) The selection of the proper type of cargo handling gear is important because most of the containers, light in construction to allow circulation of air, are easily crushed.

(4) The use of hatch tents in inclement weather is mandatory to prevent damage to cargo already stowed. Hatch tents used in the Tropics during daytime operation will keep the temperatures of cargo compartments from rising too rapidly and reduce the number of shutdowns required to allow the temperature to drop sufficiently.

b. Representatives of the port veterinarian should be present at all times during loading to inspect the condition of the cargo and the correctness of the stowage.

176. GENERAL STOWAGE CONSIDERATIONS

a. Upon the completion of loading of a hatch, an inspection of the stowage should be made by a ship's officer, a cargo loading officer, and a representative of the port veterinarian. The inspection should determine whether or not ample allowance has been made for the circulation of air and whether the boxes are properly stowed.

b. Temperature charts and cards should be maintained to record the temperatures during operations. These charts will not only record the temperatures during loading but will impress upon loading personnel their responsibility in keeping the hold at the right temperature.

c. The master of the vessel must be informed of the temperature to be maintained throughout the voyage to insure the delivery of the cargo at destination without injury.

Section XIV. STOWAGE OF DANGEROUS AND HAZARDOUS CARGO

177. DANGEROUS CARGO

a. A great part of Army cargo classified as dangerous cargo will be explosives. However, this class of cargo also will include such items as inflammable liquids and solids, corrosive liquids and acids, and gases and poisons.

b. The handling of dangerous cargo demands a wide variety of methods. For this reason, regulations dealing specifically with the commodity in question must be consulted before working the cargo. AR 55–470 and the U. S. Coast Guard publication "Regulations Governing Transportation of Military Explosives on Board Vessels During Present Emergency," NAVCG 108, revised 6 September 1945, should be consulted freely before loading.

c. The authority for enforcement of these regulations is vested with the Coast Guard; however, in the case of Army or Air Force cargo, the Ordnance Corps will provide an inspector for the purpose of giving advice on the safe handling and stowage of explosives. The Chemical Corps is responsible for inspecting and loading and stowage of dangerous and toxic cargo. A Coast Guard inspector will be available for advice upon request. It is the responsibility of the Transportation Corps personnel to see that the provisions of the regulations developed by the Coast Guard and the Army Ordnance and Chemical Corps are complied with in every respect relative to the handling of explosives and dangerous or toxic cargo.

d. Military explosives may be divided into two classes:

(1) Ammunition, which consists of all types of shells; projectiles; grenades; bombs; mines; torpedoes; torpedo warheads; powder charges; pyrotechnics; chemical, smoke, or incendiary ammunition; or other devices pertaining to the explosives utilized by the Armed Forces in the prosecution of war.

(2) Explosives in bulk which consist of any high explosives, black powder, and low explosives or smokeless powder when substances are shipped in containers such as shells, grenades, bombs, etc.

178. PROCEDURES BEFORE LOADING

a. Certain types of ammunition are extremely sensitive to mixed lots, and every possible effort must be made to preserve the integrity of the lot by stowing as a unit. In general, each lot of ammunition, 40-mm and above, should be stowed by caliber and lot number in one location. In documenting ammunition, the lot numbers must be entered on all ocean manifests, stowage plans, hatch lists, and any other documents used for shipment, so that ports of debarkation and ordnance depots can make efficient plans for proper off-loading and receiving of shipments.

b. Upon submission of a tentative loading plan and information relative to the place and approximate time of loading, the captain of the port will issue a permit authorizing such loading. Normally, the loading of explosives will be performed at previously authorized piers or anchorages; however, military explosives may be loaded or discharged at any Navy or Army depot, arsenal, port of embarkation, or other facility under direct military control and operation if authorized by the captain of the port. If no Coast Guard or Navy office is available, the loading areas for explosives will be designated by the Ordnance Corps.

c. Classification of military explosives for stowage purposes may be found in paragraphs 146.29–75 and 146.29–100 of NAVCG 108 and

in AR 55–470. The types of stowage prescribed for military explosives are described as follows:

(1) *Magazine type A.* Magazines may be constructed of steel or wood.

(*a*) If constructed of steel, the magazine will have the whole of the interior thoroughly protected by wood having a minimum thickness of three-fourths of an inch. This lining may be installed during the progress of the stowage. Stanchions, bulkhead stiffeners, steel decks, and tank tops must be completely boarded over.

(*b*) If constructed of wood, the lumber must be clean. Nails should not protrude beyond the surface. When a class A magazine measures more than 40 feet in any direction, a partition bulkhead will be fitted within the magazine as near half length as practicable, extending from the deck to at least the top of the stowage. This bulkhead must be constructed before loading.

(*c*) Detailed instructions on the construction of a type A magazine are contained in paragraph 146.29–40, NAVCG 108.

(2) *Ammunition stowage.* Dunnage must be laid over metal deck or tank tops and fitted to insure that no boxes or articles of ammunition directly contact metal parts of the vessel. Tiers of ammunition will be floored off with wood dunnage. See paragraph 146.29–41, NAVCG 108, for further information.

(3) *Chemical ammunition stowage.* Chemical ammunition is stowed preferably in a deep tank or lower hold. Both the lower hold and the deep tanks must be effectively sealed off to prevent the escape of any leakage. See paragraph 146.29–42, NAVCG 108, for further information.

(4) *Pyrotechnic stowage.* This type of ammunition will not be stowed with other ammunition or explosives unless specifically authorized and will not be overstowed with other cargo. Heat and moisture must be kept away from this type of cargo. See paragraph 146.29–43, NAVCG 108, for further information.

(5) *Blasting caps, detonators, and primers.* Before stowing this type of explosive, consult paragraph 146.29–44, NAVCG 108.

(6) *Portable magazine.* This type of magazine is not to be of greater size than 100 cubic feet capacity. It may be constructed of wood or metal lined with wood. All inner surfaces must be smooth and free of any projections. Portable magazines must be clearly marked "Inflammable" (par. 146.29–45, NAVCG 108).

(7) *Bomb-fin assemblies and fuzes.* Before stowing this type of explosive, consult paragraph 146.29–46, NAVCG 108.

d. During all loading of military explosives, strict supervision will be maintained by a ship's officer, a stevedore officer, and a qualified Coast Guard, Ordnance, or Chemical Corps inspector. Their duties are to insure that the provisions of AR 55–470 and NAVCG 108 are carried out.

e. All work in connection with the conditioning of holds, decks, or hatches for the construction of magazines must be completed before loading. No such construction will be permitted during loading. Before loading, the holds, the magazines, hatches, decks, gangways, etc., must be swept clear of all rubbish, discarded dunnage, or other loose articles. Decks over which the slings of cargo must pass will be cleaned of loose dunnage, hatchboards, etc.

f. The magazines and ammunition stowage should be located in a cool place. The most desirable locations for such stowage, listed in the order of desirability, follow:

(1) 'Tween deck hold, preferably lower.
(2) Lower hold.
(3) Square of the hatch.
(4) Shelter deck as far removed from uptakes or engine uptakes as possible.
(5) Forecastle, poop, or permanent deck house well ventilated and not in use as crew's quarters.
(6) Insulated place used for refrigerated cargo.
(7) Not immediately below the bridge.
(8) Not immediately below or adjacent to crew accommodations.

g. If it is necessary to construct a magazine or stow ammunition adjacent to engine or boiler room bulkheads, uptakes, casings, or galley bulkheads, the following must be complied with:

(1) A type wooden bulkhead must be constructed at least 1 foot off the bulkhead.
(2) Smooth side of bulkhead should face the ammunition.
(3) Nails must be set below surface. A magazine will not be constructed in bearing with the forward collision bulkhead. Stowages should be kept dry and well ventilated.

h. Before the handling of military cargo is attempted, all cargo handling gear must be thoroughly inspected by a ship's officer and a stevedore officer. This inspection will apply to both the ship's gear and the stevedore gear.

(1) No artificial lights except electric lights or electric lamps or floodlights are used in loading military explosives. Such light fixtures must be protected against accidental breakage by metal guards.
(2) Flashlights of a nonspark type will be provided for persons required to enter holds where such explosives are stored.
(3) Personnel loading or unloading military explosives will not

be permitted to have, or carry on their persons while working, firearms or matches, knives, or metallic tools of any description.

(4) Lunch boxes, pails, or thermos bottles will not be brought onto a vessel unless examined.

(5) Lunches will not be eaten in the hold of the vessel.

(6) Stevedores will not wear boots or shoes strengthened with nails or other metal unless such boots or shoes are covered with nonsparking material.

(7) No unnecessary fires will be permitted on docks, lighters, or vessels while loading or unloading military explosives.

(*a*) Barges, lighters, towboats, and other types of vessels engaged in the handling and transfer of military explosives, equipped with means of heating, cooking, lighting, or power involving the use of smoke pipes, will have such pipes protected by spark screens.

(*b*) Welding or cutting operations, involving the use of open flame or arc, will not be undertaken on a vessel having explosives on board except upon special permission of the captain of the port.

(8) Persons under the influence of liquors or drugs will not be permitted on board a vessel while operations involving the loading, stowage, or unloading of explosives are being carried on.

(9) Smoking is prohibited on or near any vessel loading or unloading explosives. *NO SMOKING* warning signs must be placed conspicuously on the pier and on a vessel during such loading.

i. All ammunition and explosives in bulk must be handled very carefully.

(1) In figure 130 note the landing mat for drafts of cargo. Ammunition and explosives will not be thrown, dropped, pulled, dragged, or slid over other cases or over the deck.

(2) In transferring ammunition or explosives in bulk, the packages may be handled by hand or by mechanical hoist or, where permitted by the regulations, a specification chute and mattress may be used.

(*a*) The maximum load of any one draft must not exceed 2,400 pounds.

(*b*) Containers of explosives will be arranged on trays, slings, or boards so that no portion of any container overhangs.

(3) Hooks will not be used for raising or lowering containers of military explosives. Bale hooks will not be used in handling packages of such explosives.

(4) Any damaged or leaking containers will not be accepted for transportation or stowage aboard any vessel.

Figure 130. Landing drafts of ammunition, using mat of old rope to cushion shock.

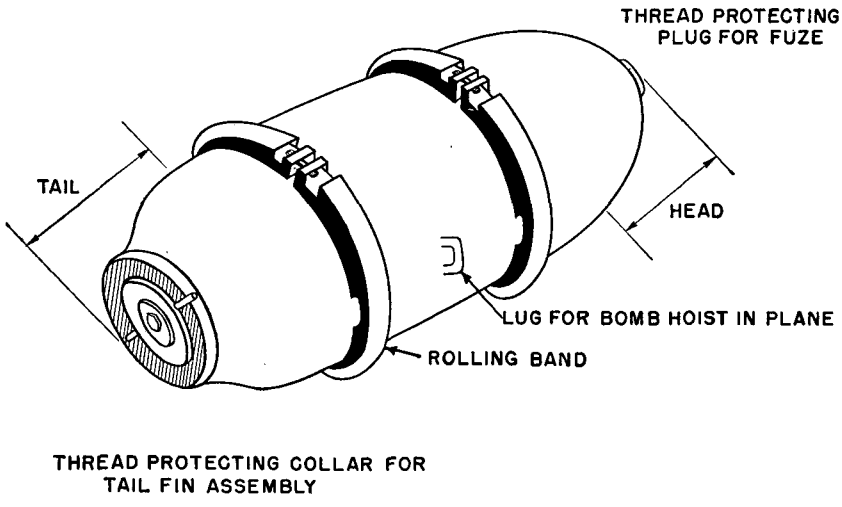


Figure 131. Nomenclature of bomb.

(5) All personnel who will be actively involved in the loading, stowing, or discharge of military explosives must be familiar with NAVCG 108.

179. HANDLING AND STOWAGE OF BOMBS

a. Since most bombs are handled individually and not in containers, each bomb must be hand stowed.

(1) The nomenclature of a bomb as discussed in this paragraph is shown in figure 131.

(2) Preparation of a hold is discussed in paragraph 178.

b. Three basic methods of stowing heavy bombs are as follows:

(1) *First method.*

(*a*) Place two timbers (fig. 132), athwartship in the hold to form tracks to rest the bomb on. These timbers must be higher than the rolling bands of the bombs.

(*b*) The bombs are rolled across the deck of dunnage and placed on the tracks, band to band (fig. 133).

(*c*) Chock every second bomb with dunnage to prevent rolling (fig. 133).

(*d*) Brace the last bomb securely against the side of the hold.

(*e*) To protect the head and tail fins of the bombs, separate the second row from the first by use of dunnage as shown in figure 134.

(*f*) To load succeeding tiers, prepare a track (as in (*a*) above) to use on top of the first row of bombs. No floor of dunnage is required between the tiers.

(*g*) The rolling bands of the second tier of bombs are directly above those of the first (fig. 135).

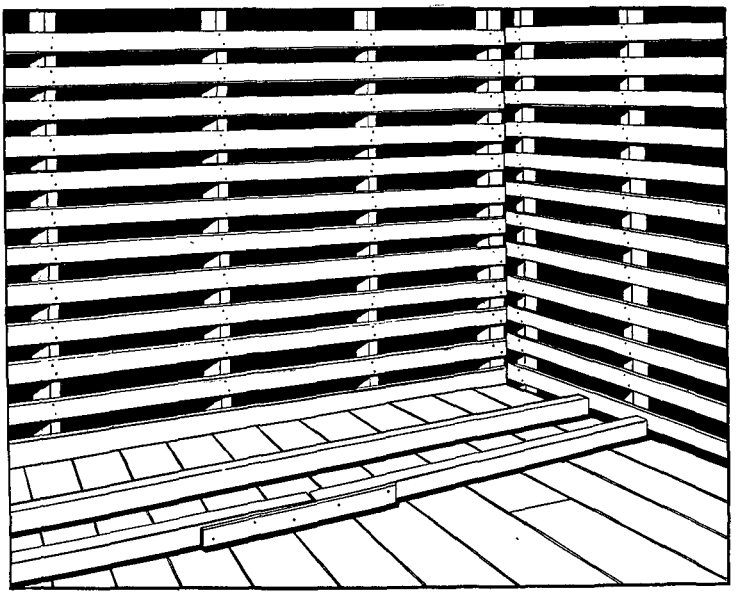


Figure 132. Preparation of a hold for receiving bombs.

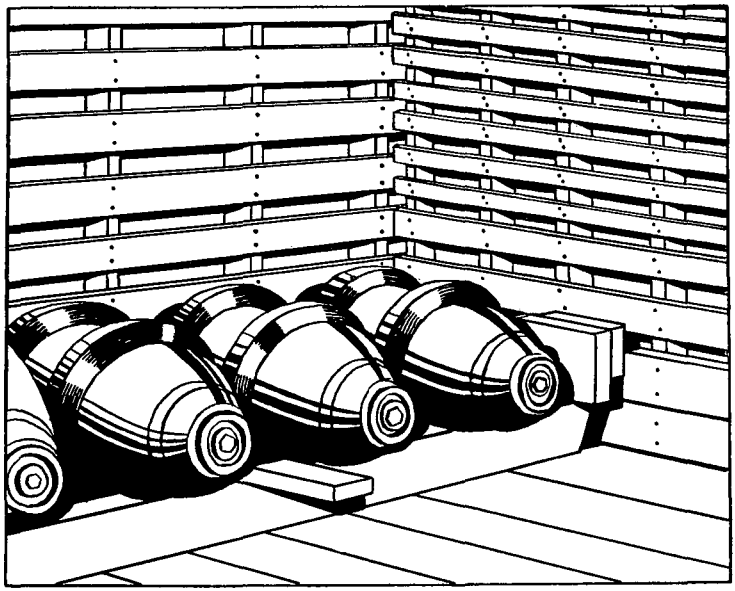


Figure 133. Stowing first row of bombs.

Figure 134. Dunnage used to separate rows of bombs.

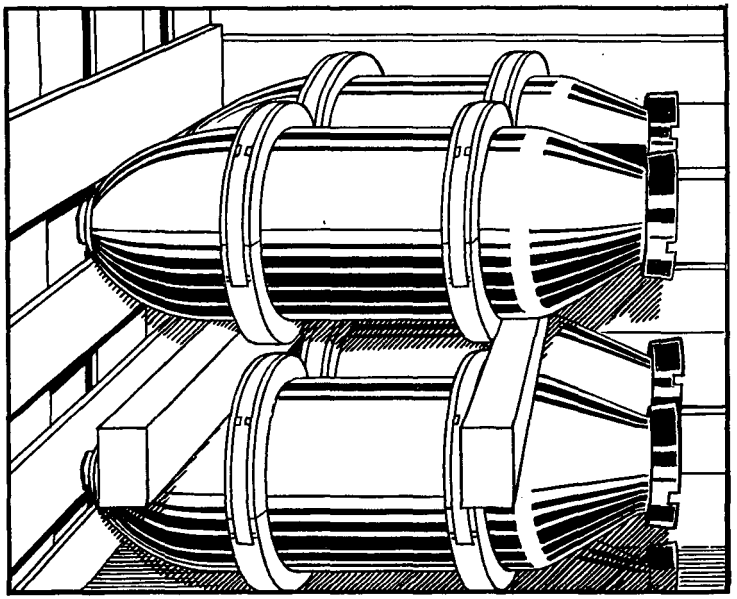


Figure 135. Band-to-band method of stowing.

(*h*) This method may be altered by interlocking the rolling bands of the bombs as shown in figure 136① and ②.

(2) *Second method.*

(*a*) No athwartship timbers are required as in the first method ((1) (*a*) above). The first row is started directly on the dunnage floor.

(*b*) The end bombs are braced against the side of the hold ((1) (*d*) above).

(*c*) Dunnage is placed between the rows as described in (1) (*e*) above.

(*d*) Lay 2- by 4-inch timbers athwartship to clear the rolling bands of the first tier.

(*e*) Lay a floor of dunnage over the athwartship timber and continue the second tier in the same manner as the first.

(3) *Third method.*

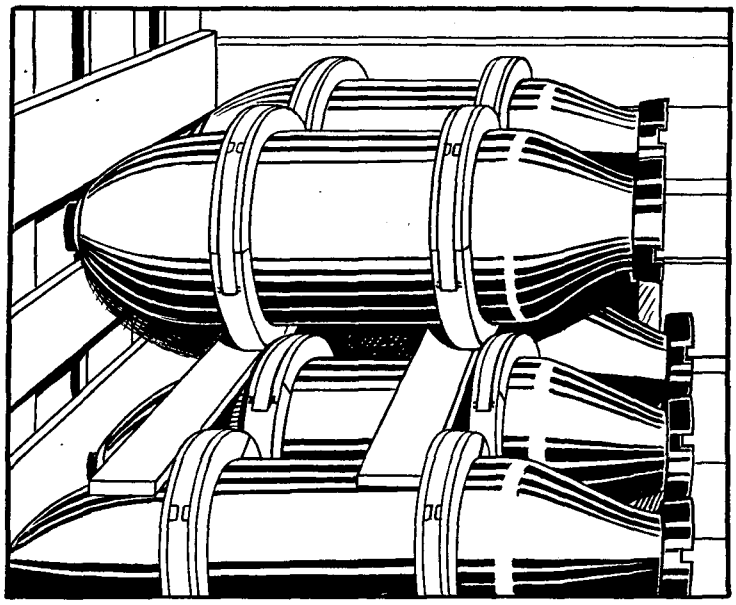
(*a*) This method differs from the previous method in that every other bomb is turned end for end.

(*b*) The tail of one bomb is adjacent to the heads of the adjoining bombs.

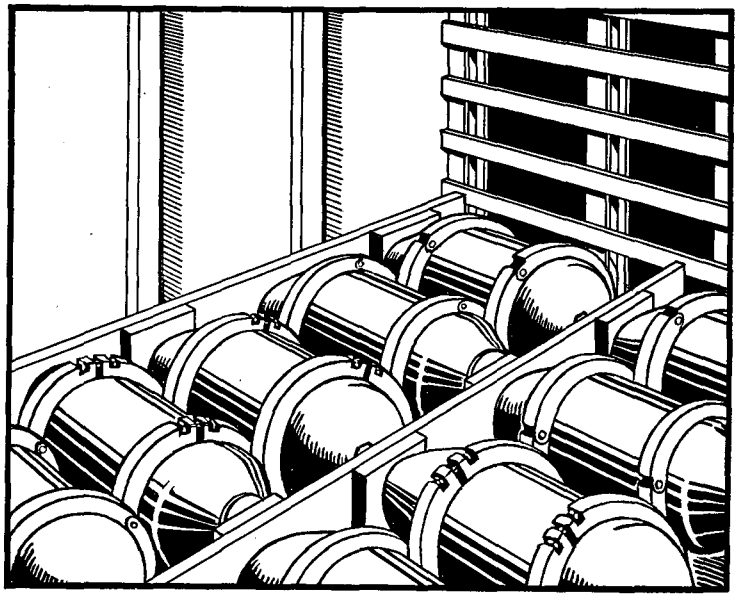
(*c*) The rolling bands are interlocked.

c. Although the above methods (*b* (1), (2), and (3)) deal only with fore and aft stowage, bombs may be stowed athwartship to fill in unused space (fig. 137).

d. The last tier of bombs must be held in place to prevent shifting by loading other cargo on top or by tomming.



①



②

Figure 136. Interlocking method of stowing.

180. HAZARDOUS CARGO

Liquids that might contaminate other cargo below deck in the event of leakage must be stowed on deck (fig. 138).

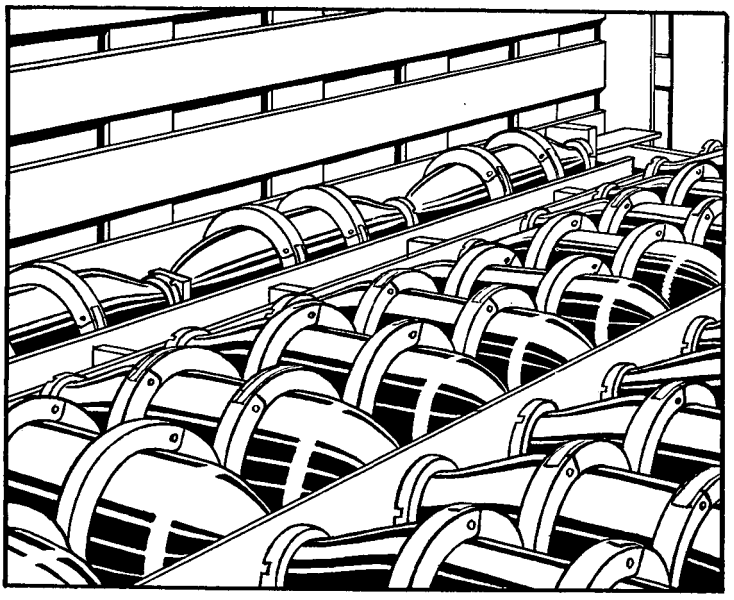


Figure 137. Athwartship stowage to utilize space.

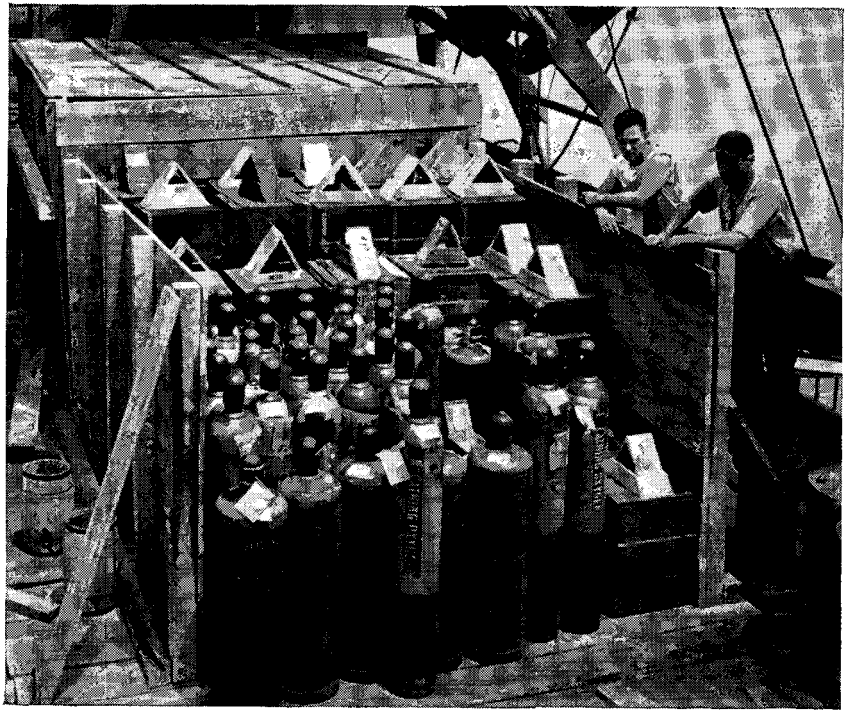


Figure 138. Stowage of dangerous cargo on deck.

a. Acids and other small-case cargo stowed on deck must be stowed in a block with a solid bin made of not less than 2-inch planking.

b. Two-inch planking must be placed on top of the cargo in the bin to permit its being securely lashed down.

c. Boxing in with 2-inch planking is not necessary in all waters, but such cargo must be adequately secure.

d. If acid is stowed more than one container high, 4- by 6-inch lumber should be used between the necks of the carboys and a solid floor of dunnage should be placed on the first tier before the second is stowed.

e. The bin should be well braced off and lashed down.

f. Containers of poisonous articles must be stowed well away from living quarters, refrigerator cargo, and foodstuff of every description.

Figure 139. Labels for hazardous cargo.

181. LABELING OF DANGEROUS AND HAZARDOUS CARGO

a. Cargo which is dangerous, inflammable, or both will have a colored label pasted conspicuously on the outside to indicate the type (fig. 139).

b. The four types of labels for cargo are as follows:

(1) Red—inflammable liquid.
(2) Green—compressed gas.
(3) White—acids.
(4) Yellow—inflammable solids.

Section XV. TRANSPORTATION OF ANIMALS

182. ANIMALS FOR MILITARY REQUIREMENT

The most common types of military animals are horses, mules, and experimental animals. The carriage of animals by sea is governed by the laws and regulations of the Bureau of Animal Industry, Department of Agriculture.

183. METHODS OF LOADING OR DISCHARGING

Animals may be loaded or discharged by two methods.

a. They are led over ramps.

(1) This method is used for all small animals and is the most common method for larger animals.
(2) The animals, preceded by a gentle animal, will be led quietly without interruption.
(3) Ramps and decks must be covered with sawdust, cinders, etc., to provide a firm footing and prevent injury.

b. They are hoisted aboard by means of slings or flying stalls (fig. 74).

(1) When animals are to be placed in slings, all apparatus must be carefully inspected to prevent injuries.
(2) The animals should be hoisted steadily and rapidly.

184. SHIP ACCOMMODATIONS

a. Small animals are carried in portable crates either in a sheltered location on deck or a well-ventilated area below decks.

b. Larger animals, such as horses and mules, require the following accommodations:

(1) Each animal will have not less than 6 feet 3 inches of clear vertical space from beams of deck or the roof overhead to flooring underfoot.
(2) Each animal will have individual space of not less than 2 feet 6 inches with not less than 8 feet in depth. Very large horses or mules or mares in foal will be furnished additional space.

(3) Footlocks are to be placed for all pens in which animals are carried.

(4) Special care will be taken to provide methods for withdrawing the foul air and pumping in fresh air. Means of ventilation available are hatchways, portholes, windstoops, electric fans, funnels, and blowers.

(5) Small numbers of horses and mules may be shipped in crates or portable stalls of sufficient strength and size to carry them safely.

(*a*) All such crates and stalls must be properly equipped for feeding.

(*b*) For animals carried in portable crates or stalls on deck, provision will be made for a suitable roof to protect each animal from weather conditions.

c. Grooming and exercise will be carried out whenever possible. Each animal will be taken out of his stall, pen, or crate for a few minutes each day and moved about.

d. Sufficient attendants are to be provided for the animals carried on the general basis of one attendant for every 25 animals.

185. MEDICAL CARE

a. No animals may be shipped until they have been inspected and found free of communicable disease.

(1) The veterinary officer performing the inspection is responsible for compliance with all state and Federal sanitary lift requirements.

(2) All cars, stalls, pens, crates, etc., to be used in transporting animals will be completely disinfected before loading.

b. No animals will be loaded aboard a vessel until they have been allowed 5 hours rest in suitable quarters at a port of embarkation.

c. A transport veterinarian will be assigned to all animal-carrying transports. He is responsible for the proper care of all sick or injured animals and acts as advisor to the transport remount officer. See AR 55–485 for further information.

Section XVI. STOWAGE OF DECK CARGO

186. GENERAL

a. All combat and transport vehicles, equipment, and other cargo, subject to damage by sea water, must be loaded and stowed below deck unless—

(1) They are too large to go through the hatches (figs. 140 and 141.)

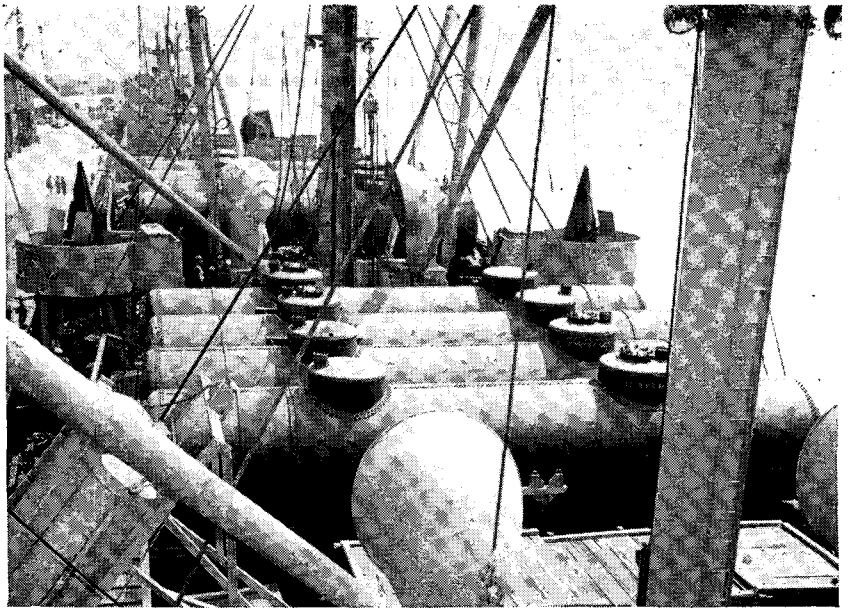


Figure 140. Tank cars stowed on deck.

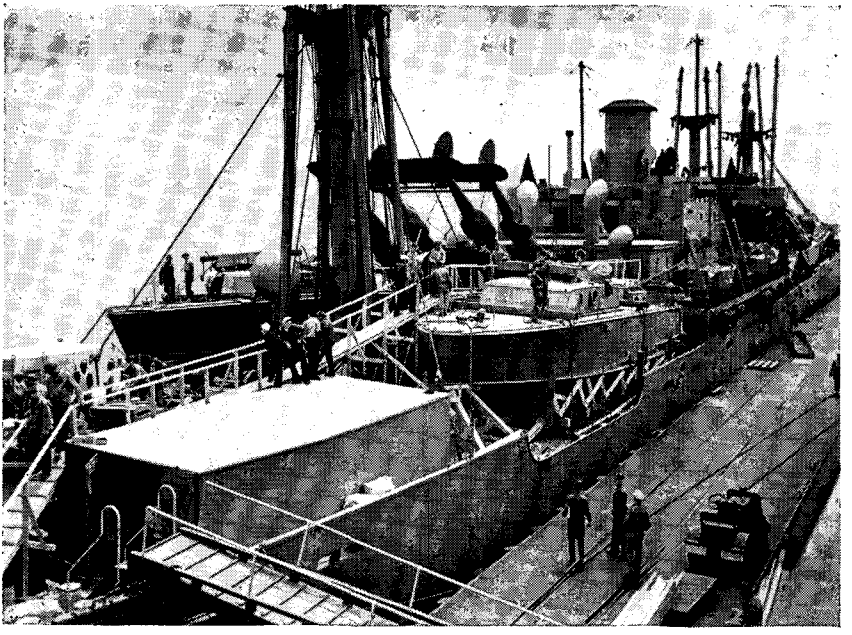


Figure 141. Liberty-type vessel showing example of deck-load during World War II.

(2) There is no room below deck, and shipment cannot be delayed.
(3) The nature of the cargo is such that deck stowage is required by law and regulations, or by the generally recognized customs of the shipping trade.

b. When it is necessary to load cargo on deck, precautions must be taken to insure that such cargo is processed or otherwise protected from damage by sea water.

c. In this section examples of proper stowage of different deck cargo will be given. Proposed deckloads and securing thereof will be discussed with the ship's master. No deckloads should be loaded without

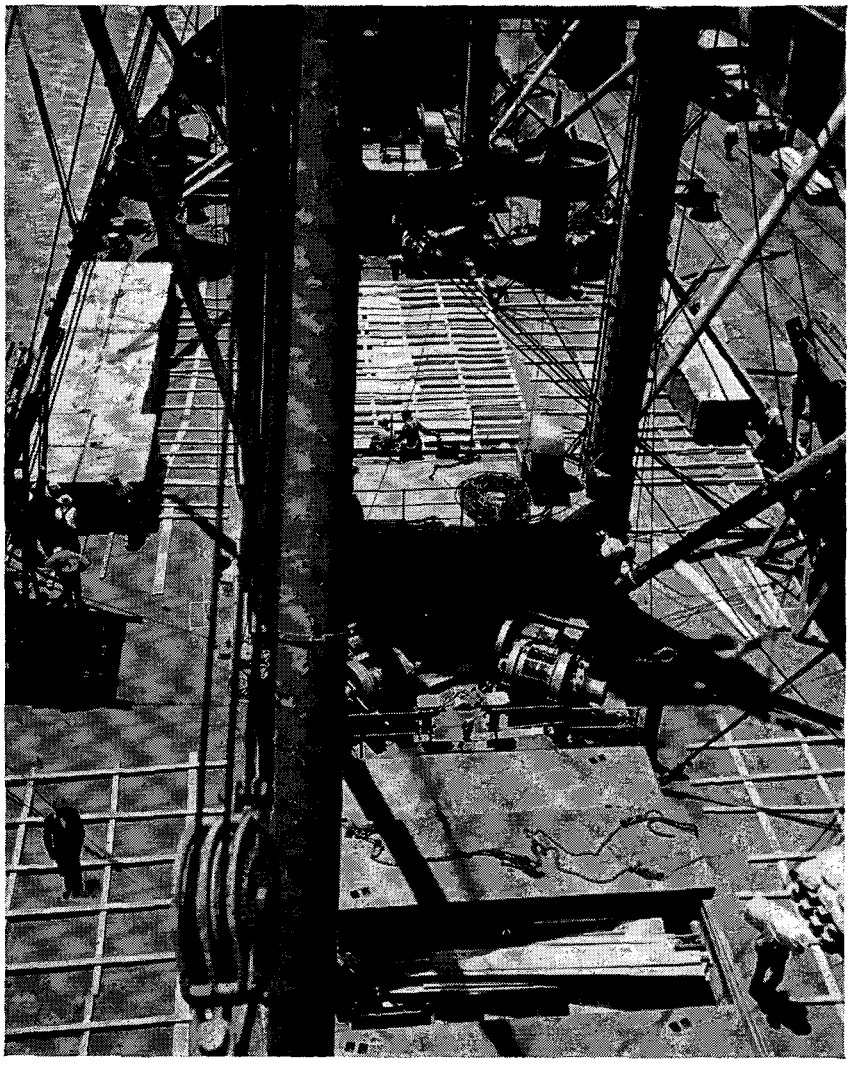


Figure 142. Deck prepared with strips of dunnage for receipt of deck cargo.

his permission. In figure 142 strips of dunnage have been used on deck to receive cargo, thus permitting easy removal of slings and providing protection against water on deck.

187. AREAS TO BE AVOIDED

a. When stowing a large amount of cargo on deck, care must be taken to avoid blocking off the following equipment:

(1) Bits and chocks.
(2) Sounding pipes to the bilges and ballast tanks.
(3) Handles of valves controlling the opening of watertight bulkheads or piping systems.
(4) Any other pieces of equipment essential to the safe operation of a vessel.

b. It is good practice to outline in chalk the spaces to be kept clear.

188. PRECAUTIONS

a. Winter Zone

(1) Deck loading of the cargo should be restricted to the after deck and to the squares of the hatches with the exception of No. 1 hatch.
(2) Cargo placed on the squares of the forward hatches should not exceed 9 feet in height.
(3) No cargo should be loaded in wells except by special permission. This permission will allow only unboxed locomotives, tanks, or other cargo that can be literally welded to the deck.

b. Summer Zone. When necessary, cargo may be carried on decks and hatches fore and aft.

c. Other. Judgment must be exercised with respect to type and characteristics of such cargo, adequate securing, and the height of the individual pieces. The type of vessel and available freeboard will be a primary consideration.

189. CATWALKS

Catwalks should be constructed for the safety of the crew (fig. 143).

a. These walks should not be less than 3 feet wide and should be given good leads.

b. Straight ladders to the well deck should be avoided.

c. Ramps should be built to the main deck so that the crew will have ready access to lifeboats, gun stations, and other installations.

190. CASES ON DECK

a. Deck cargo should be stowed so that it can be lashed in three separate blocks; one on the square of the hatch and one on each side (fig. 144).

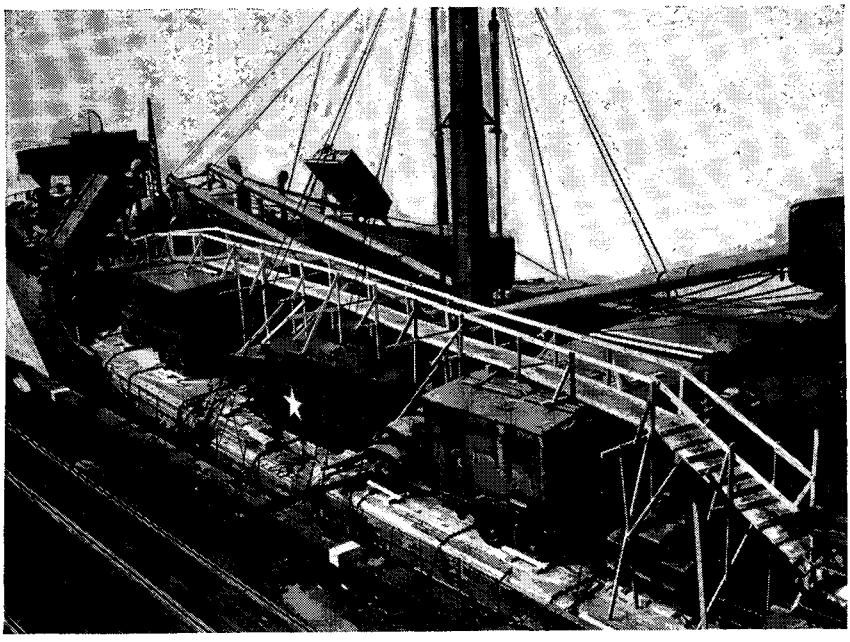


Figure 143. Catwalk built over deck cargo.

(1) If the nature of the deckload so warrants, additional over-all lashings may be used.
(2) Lashings may be either wire, rope, or chain.
(3) Angle irons are to be used under the lashing to prevent cutting into the case.
(4) Exposed forward parts of the cases should be sheathed for protection against sea water.
(5) Tables must be built up under the overhang of any cargo extending from the square of the hatch.
(6) No overhang is permitted on vessels proceeding in the seasonal winter zones.
(7) When securing cases on deck, bracing or tomming is preferable to shoring, as shoring has a lifting effect on cargo.
(8) Lag screws or bolts should be used to tie the timbers together. Nails and spikes should only be used on small timbers or where it is impossible to use screws and bolts.

b. Additional information on lashing is included in paragraphs 146–150.

191. WHEELED VEHICLES ON DECK

One method of lashing vehicles on deck is pictured in figure 145.

a. Dunnage must be placed on deck under the wheels; the wheels are then chocked, as described in stowage of vehicles below deck.

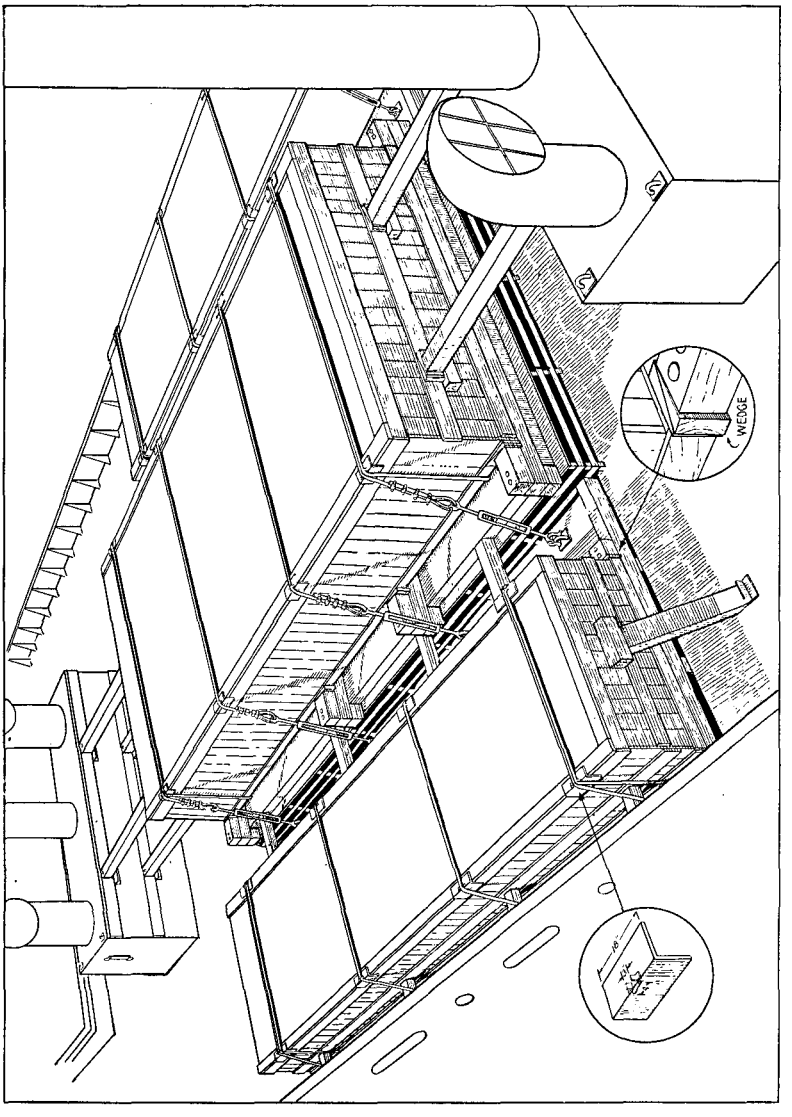


Figure 144. Cases secured on deck.

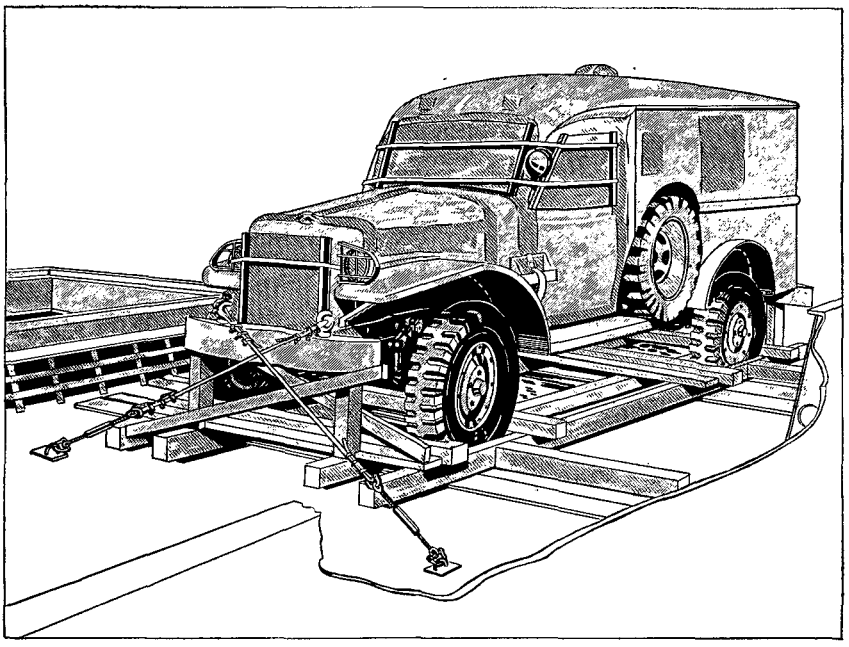


Figure 145. Vehicle secured on deck.

Figure 146. Typical lashing of vehicles on deck.

Care must be taken to brace wheel chocks. Two lashings are required on the front and two on the rear of vehicles such as trucks and ambulances. These lashings may be either crossed or led outboard from the vehicle.

b. The chassis should be blocked up to take the weight of the body, and the compression should be applied by lashing off the springs.

c. Lashings may be made fast to the front axle in lieu of chassis lashings. In this case, it is not necessary to block under the springs.

d. Figure 146 illustrates typical deck loading of vehicles.

192. TRACKED VEHICLES

a. Securing of tanks and other tracked vehicles is accomplished as follows:

(1) Land vehicle treads on two 4 by 12 timbers.

(2) Secure an 8- by 12-inch timber against the threads on each side by three angle irons. Each angle iron must have holes for two 7/8-inch lag screws to be used to secure the 8 by 12 timbers.

(3) Each end of the vehicle will be chocked with a timber placed against the treads and secured against the fore and aft timber mentioned in (2) above.

(4) Lash each end of the vehicle with two 1¼-inch turnbuckles and tie rods. Lashings may be crossed as shown or led outboard.

b. Sizes of timbers prescribed are merely guides, as the proper material may not always be available in oversea areas.

193. LOCOMOTIVES

a. The steam locomotive is probably the largest and most difficult piece of cargo that Army stevedores may be required to handle. The loading and discharge of this piece of equipment is done by experienced men and special equipment (fig. 147). However, stevedores may be required to perform the shoring and lashing.

b. A representative locomotive used by the Transportation Corps has a wheel base of 23 by 5 feet and a weight of 141,500 pounds. This weight rests on an area of 115 square feet, resulting in a load of 1,230 pounds per square foot. Since the deck of the average vessel will support not more than 300 to 400 pounds per square foot, shoring is necessary in the 'tween decks and the lower hold to support this weight.

c. In order to spread the weight as effectively as possible, the wheels of the locomotive will rest on sleepers on deck (fig. 148).

(1) Spreaders will be used between these sleepers and secured by four tie rods of at least 1-inch rod iron, threaded 4 inches on each end to take a stud nut and washer.

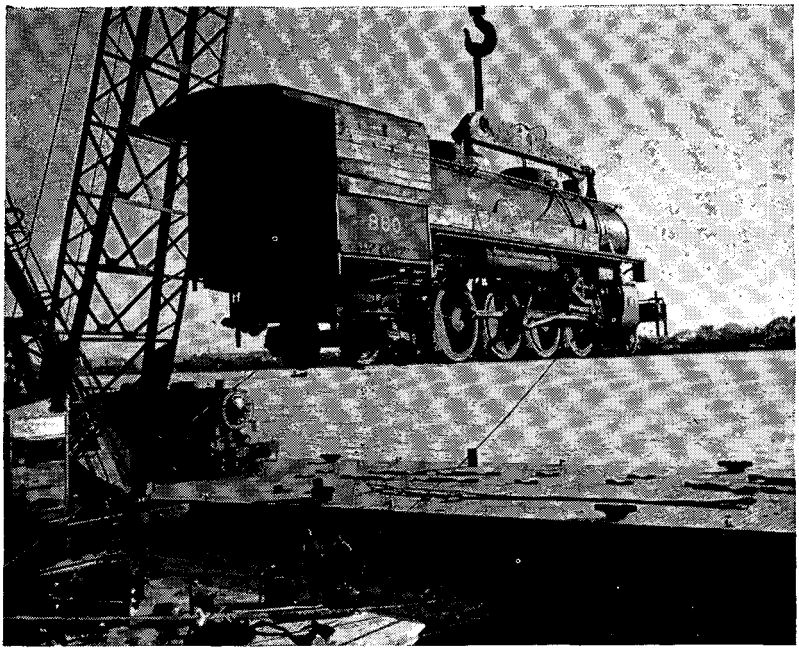


Figure 147. Loading locomotive with floating crane.

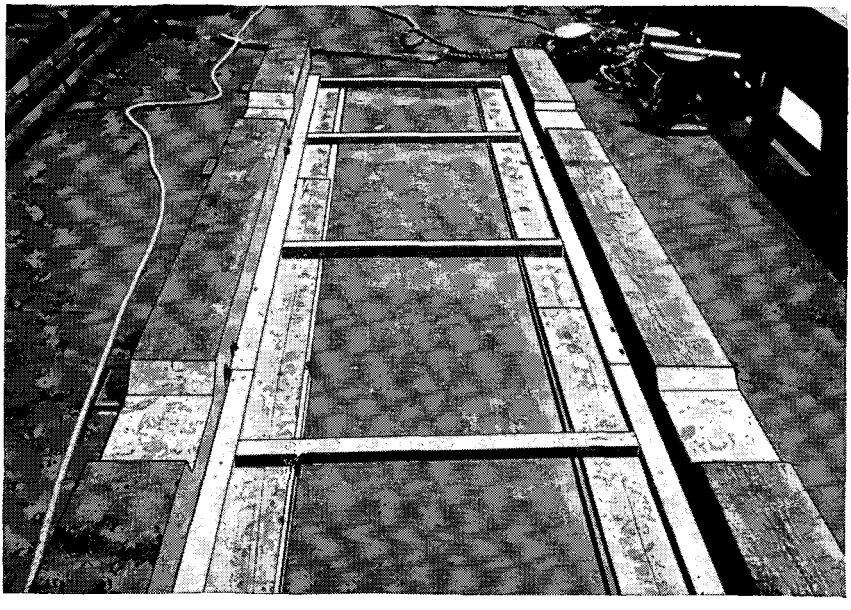


Figure 148. Bed prepared on deck to receive locomotive.

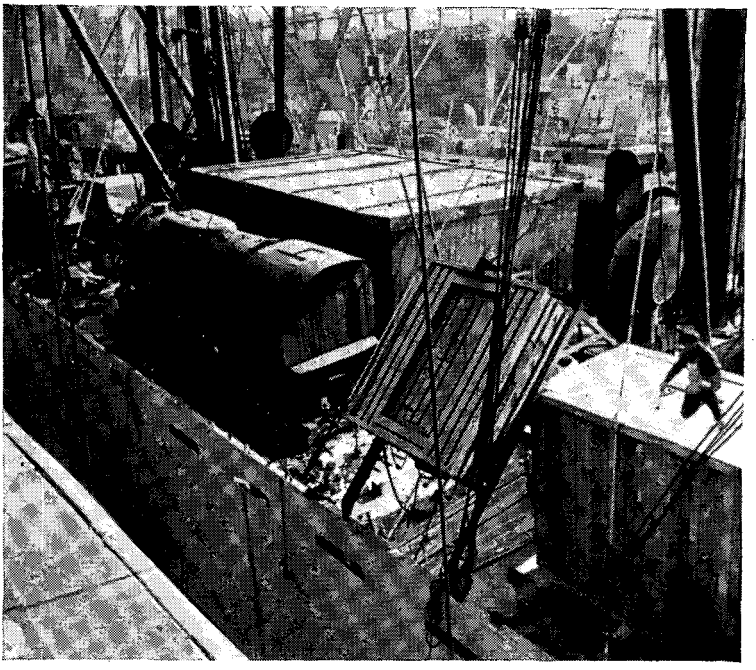


Figure 149. Deckload showing position of locomotive.

(2) The spreaders are not to be secured to the fore and aft stringers but are to act as spacers and are held by clamping action of the rods.

d. Shoring in the 'tween deck and lower holds is accomplished by bracing the decks with at least 12- by 12-inch timber as shown in figure 106. If 12- by 12-inch timber is not available, 8- by 8-inch or 10- by 10-inch may be substituted, but a corresponding number of additional shores will be required. The shoring will be placed in two rows under the sleepers directly beneath the deck frames with timber braces placed under the deck and between the deck beams to assist in evenly distributing the weight of the locomotive.

e. Figure 149 shows locomotive on deck.

194. SMALL BOATS

Harbor craft present a special transportation problem because of their size, weight, and comparative fragility.

a. Because of their size, almost all harbor craft carried must be stowed on deck.

b. The shape of a craft so carried is such that a cradle must be constructed for the boat to fit into. These cradles may be constructed by the manufacturer especially for the particular type of harbor craft;

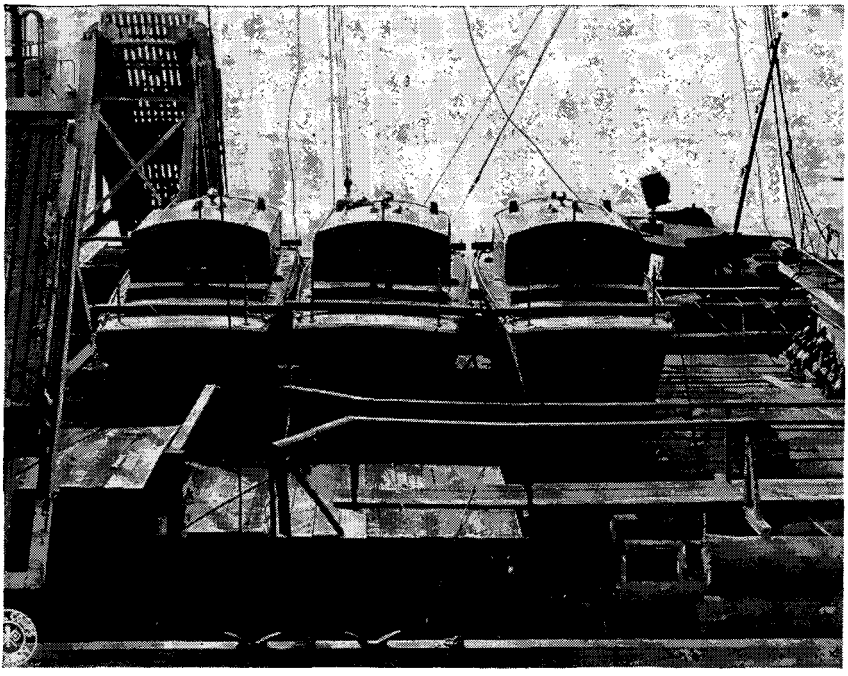


Figure 150. Small boats stowed on hatch.

however, in most cases the loading agency will have to construct them of materials available.

c. Because the craft will sit high in the air and are more susceptible to the forces of wind, sea, and the motion of the vessel, lashing must be applied carefully and properly (figs. 141 and 150).

CHAPTER 11

DISCHARGING

Section I. DISCHARGING AT PIER OR WHARF

195. RIGGING

Normally, a ship will arrive at the discharge point with its gear rigged and raised. The ship's crew rigs the gear just before the vessel arrives so that the stevedores may proceed with the discharge operation with the least delay practicable. The discharging stevedores should need only to spot the booms in the desired locations for the type of operation to be performed and to open the hatches.

196. REMOVING DECK CARGO

Deck cargo must be unloaded before hold operations can begin. Even if the deck cargo has been placed so that it will not interfere with the discharge of the hatch, such deck cargo must be removed first to provide more room to work on deck unless it is destined for another port of call. The same precautions practiced during deck loading must be exercised during discharge.

197. BREAKING OUT CARGO IN HOLDS

In discharging, the cargo in a hold should be kept as level as possible. Breaking out cargo more than man high or tunneling under other cargo is *prohibited.*

198. USE OF PORT CLEARANCE EQUIPMENT

a. One of the most important phases of stevedoring is port clearance. Cargo which is allowed to accumulate on the pier will hinder and eventually bring to a standstill the discharging operation. It also becomes subject to damage and pilferage.

b. Pier and port personnel must effect port clearance of all cargo as quickly as possible by means at their disposal. The type of cargo and stowage aboard ship determines the method of pier and port clearance which will be used.

(1) In combat moves, vehicles are normally loaded so as to be in condition to move from the ship under their own power.

It should be necessary merely to connect the batteries; gasoline tanks are three-quarters full when loaded.

(2) Vehicles being received for stock or resupply are frequently processed for shipment before loading and must be towed off the pier by other vehicles or tractors.

(3) Block-stowed cargo of the same service may be loaded directly into trucks and trailers or railway equipment for delivery. This is a fast and efficient method of port and pier clearance as the cargo is handled only once.

(4) Where quantities of cargo belonging to several services are being unloaded, it may be quicker to line up transportation on the pier by service and transport drafts of cargo from the hook with fork lifts. This type of operation requires a larger pier area.

(5) If an in-transit warehouse is available in the immediate vicinity, cargo may be transported from shipside by means of trucks, tractors, etc., without regard to service. In the in-transit warehouse the cargo can be segregated by service and destination. This type of operation is used where the rate of discharge far exceeds the availability of transportation. In any event the piers must be kept clear for continuous discharge and backloading.

Section II. DISCHARGING OFFSHORE

199. GENERAL

The offshore discharge of cargo by means of various types of water craft is necessary when terminal facilities on shore are nonexistent, damaged, destroyed, or otherwise unavailable, or when the vessel must be lightened. It is possible to expedite discharge by using a floating crane and barges offshore in addition to working cargo to the pier.

200. EQUIPMENT

For a successful offshore discharge, certain craft must be available.

a. Barges and Lighters.

(1) Since very few lighters are equipped with cargo handling gear, shore cranes or other devices must be secured for their discharge.

(2) Lighters should not be worked in rough seas unless absolutely necessary. The use of lighters is usually confined to harbors, inland waterways, rivers, or protected anchorages.

(3) When loading a lighter, the cargo should be evenly and tightly stowed. In discharging a lighter, care should be exercised to discharge cargo evenly to prevent danger of the lighter's capsizing.

(4) Personnel must take practically the same precautions in handling such special-type cargo as ammunition, vehicles, and heavy lifts as they would aboard ship. Separation of cargo is equally as important as aboard ship, and dunnage, chocking, and lashing are likewise required.

b. Landing Craft. At present, there are three types of landing craft in common use.

(1) *Landing craft, vehicle-personnel (LCVP).* The LCVP is a 36-foot, single-engine craft capable of carrying 36 men and their baggage or vehicles up to and including a ¾-ton carrier. Generally used to carry and land assault troops, the LCVP can be transported either slung on a ship's davits or on deck. It can be lowered with a full load over the ship's side provided capacity of ship's booms and/or boat davits permits.

(2) *Landing craft, mechanized (LCM).* An LCM is ordinarily used for transporting tanks and vehicles. Capacity loads up to 30 tons can be accommodated by its 37-foot cargo space. The LCM is a twin-screw craft powered by two Diesel engines. It may be transported on a ship's deck. Because of its weight (25 tons), there is usually one boom on a cargo ship capable of lowering the craft over the side.

(3) *Landing ship, utility (LSU).* The LSU is approximately 120 feet long with a beam of 32 feet. Powered by three Diesel engines, this craft is particularly useful in moving tanks and heavy vehicles ashore. After the assault phase of an invasion, the LSU is valuable as a self-propelled barge transporting cargo from ship to shore.

(4) *Floating cranes.* There are various types, the most common being the 30-ton, 60-ton, and 100-ton cranes. These craft are nonpropelled and are invaluable in discharging heavy lifts from vessels at anchorage or alongside a pier.

(5) *Amphibious truck.* The amphibious truck is the standard 2½-ton, 6x6 truck made amphibious by the addition of a boat hull and a water propeller driven by the engine. For land operation the vehicle has six driving wheels driven by a conventional six-cylinder engine. Afloat, it is driven by water propeller and steered by a rudder, both of which are mounted in a tunnel at the rear. Cargo space in the rear of the vehicle will accommodate approximately 25 men and their equipment or 5,000 pounds of cargo (FM 55–150).

201. PROCEDURE OF DISCHARGING

a. In most types of offshore operations, planned stowage need not be attempted; however, care must be taken not to overload.

(1) When a barge is to be towed a long distance, a stowage plan should be made to prevent its being down by the head or down by the stern, thereby increasing the difficulty of towing.

(2) In stowing, a barge must be worked from both ends toward the middle to avoid the danger of its capsizing because of too much weight on either end. Loading from both ends causes the barge to settle evenly in the water.

b. Amphibious vehicles and small landing craft are normally worked on the lee side of the vessel loading cargo direct from the ship's booms.

c. The craft to be loaded is secured to the vessel by a single spring line led from the deck of the vessel. It is held into the side of the ship by turning its propellers slow ahead, keeping a tension on the line. The spring line can be slacked off or taken in by the deck crew aboard the vessel in order to locate the cargo space of the craft directly beneath the ship's boom.

d. For discharge operations, spot the outboard boom about 5 feet beyond the rail of the vessel.

e. Drafts of small items of cargo are generally slung in a cargo net, which is unhooked and left in the craft being loaded. An empty net is returned each time the craft comes alongside for an additional load.

f. Drafts should not be allowed to swing as they will strike the side of the vessel or damage the craft in the water.

g. In rough water, land the draft at the crest of a wave; immediately slack off on the runner to prevent the draft from being hoisted as the craft falls into the trough of a wave.

h. Do not allow longshoremen or crew members to remain inside the cargo space when landing drafts in amphibious trucks or landing craft.

Section III. DISCHARGING FROM FLOATING EQUIPMENT TO PIER

202. EQUIPMENT USED FOR DISCHARGING

a. In most cases barges and lighters are not self-discharging and must rely on an outside source of power to discharge the cargo and load into mobile equipment for delivery. This power is supplied by floating cranes, land cranes, and manpower depending upon unloading facilities (fig. 151).

b. The most desirable situation for discharging is by the use of land cranes on a pier. The land cranes reach from the pier to the barge, pick up a draft, and land the draft on the pier or on the bed of a truck.

c. If land cranes are not available, ramps may be built so that trucks and fork lifts may operate on the barge itself.

Section IV. DISCHARGING TO BEACH

203. GENERAL

a. In nearly all combat operations, there will be cargo operations over a beach. How long these operations will continue depends on the terminal facilities available (fig. 152).

b. Beach operations are peculiar in that the cargo is transferred from ship to shore at the water's edge. The ground over which the transfer is effected is usually soft and a hard surface must be secured to provide traction for the vehicles. In the typical beach operation illustrated in figure 153, note the tracked fork lift for use in soft sand.

c. Several factors must be taken into consideration before the selection of a beach for cargo operations.

(1) If the tidal variation is great, plans must be made to use the beach during both low and high tides. Vessels with flat bottoms, such as barges and lighters, may be brought in at high tide. As the tide recedes, they will be left high and dry so that trucks may be driven alongside the vessels and unloading may be done during the period of low tide. The lighters should not be loaded with more cargo than can be discharged at the beach during low tide. In landing craft operations, care must be taken that a craft is not stranded during low tide; otherwise half of its usefulness is lost.

(2) Surf is another governing factor in the selection of a beach for cargo operations. Waves breaking on a beach may cause landing craft to broach. On flat beaches, waves break and are spent before reaching the shore. Over steep slopes, surf breaks near the shore line and will consequently have more effect on the beaching of craft. Where reefs exist, waves break over the reefs and leave the inner area relatively unaffected.

(3) Gently shelving beaches cause landing craft to ground far from the shore line and large ships to anchor a great distance out. This increases the hazard and time required for unloading. Steep gradients allow landing craft to ground close to shore, but there is likely to be heavy surf.

(4) In many places, reefs and shoals fringe the shore line and must be studied before beach operations are undertaken. A minimum depth of 4 feet should be available over reefs or shoals at low tide.

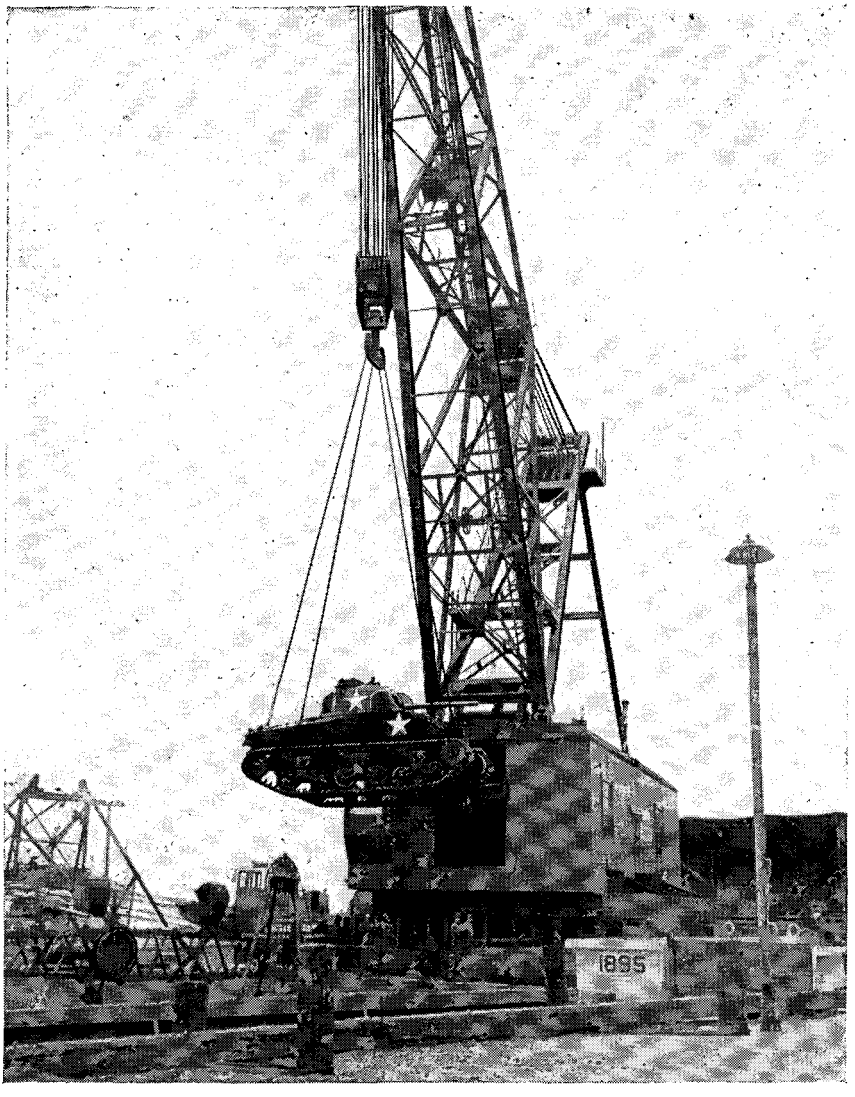


Figure 151. Floating crane discharging tank from barge to pier.

204. LANDING CRAFT USED IN BEACH OPERATIONS

There are numerous types of landing craft in use for beach operations. These types vary in length from approximately 30 feet to more than 300 feet. All depend upon loading or discharging through ramps and none have cargo gear of their own. Consequently, discharging of landing craft must be done by outside sources of power, such as floating cranes, land cranes, materials handling equipment, trucks, and man power.

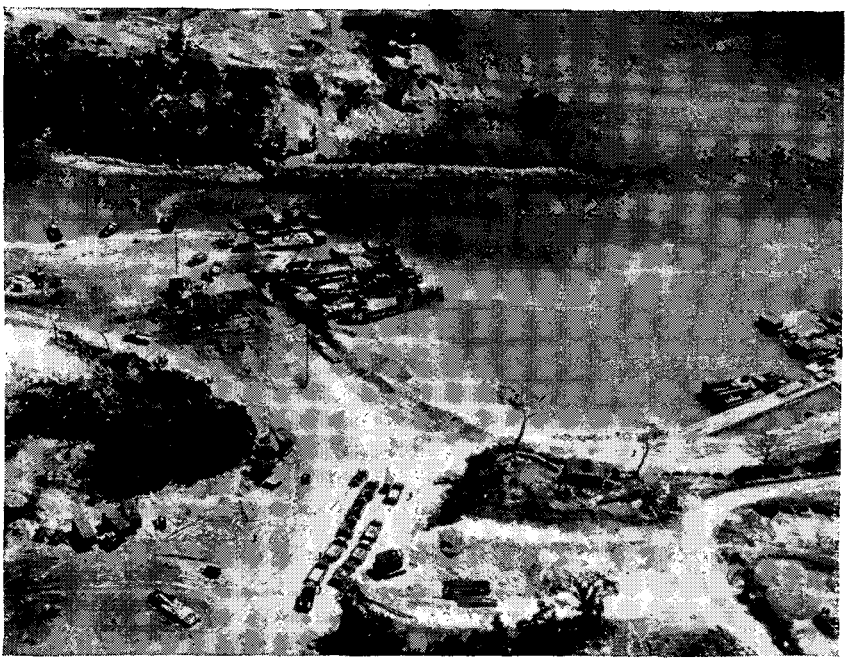


Figure 152. Small beach operation.

205. EQUIPMENT USED IN DISCHARGING

a. Beach operations differ from normal discharge operations in that the cargo is unloaded at the water's edge instead of from the pier or bulkhead, and the vessels used are normally not self-discharging.

b. The equipment required is generally the same as that employed in normal discharge operations but is used in a different manner.

(1) Shore or crawler cranes are placed at the water's edge where they may reach into the smaller landing craft, pick up the draft, and swing it into waiting trucks (fig. 154).

(2) Bulldozers and other tracked vehicles may be used to tow the vehicles from the landing craft across the beaches (fig. 155).

(3) On a hard-surface beach or where a hard-surface roadway has been prepared, trucks may be driven inside LST's or loaded by a crane from smaller landing craft.

(4) An additional use of equipment in beach operations is to place a crawler or land crane on the deck of an LST to discharge cargo through the cargo hatch to a barge alongside. This operation expedites the discharge of the vessel but requires double handling of the cargo.

c. All landing craft are provided with bow ramps for the purpose of bridging the gap between the craft and the beach. Because of the varying types of beaches, the bow ramps may not reach dry land and

Figure 153. Typical beach operation employing a tracked fork lift in soft sand.

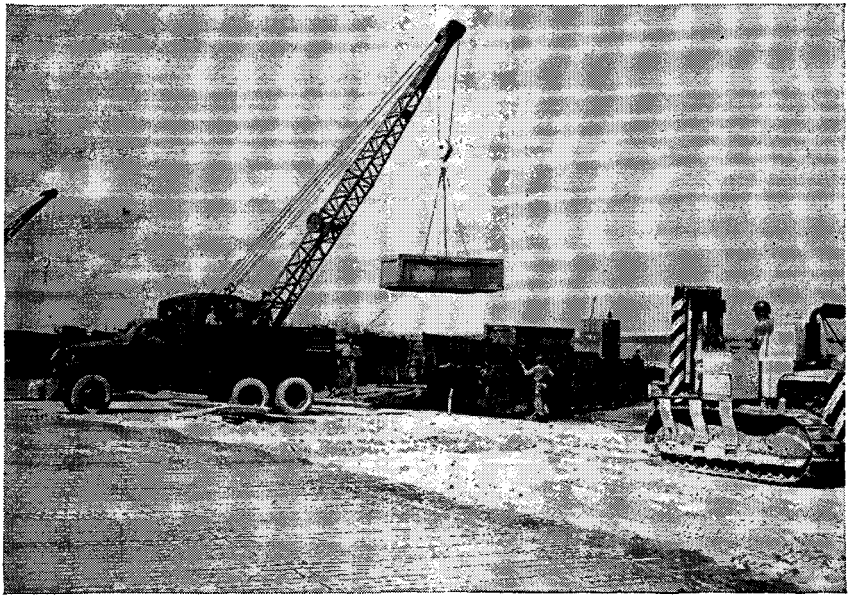


Figure 154. Discharging LCM's to trucks by means of a crane at water's edge.

a wooden ramp must be constructed to bridge the gap and allow trucks and tractors to enter and leave the landing craft. This ramp must be portable yet heavy enough to support a loaded truck. It should be lifted in place by a land crane.

d. If the beach is too soft to permit the operation of trucks, a wooden sled may be constructed and towed by a vehicle. Cargo discharging by this method is slow and tedious.

e. At times, cranes will not be available to discharge at beachhead dumps, and gin poles or an A-frame must be constructed. See TM 5–225 for such construction.

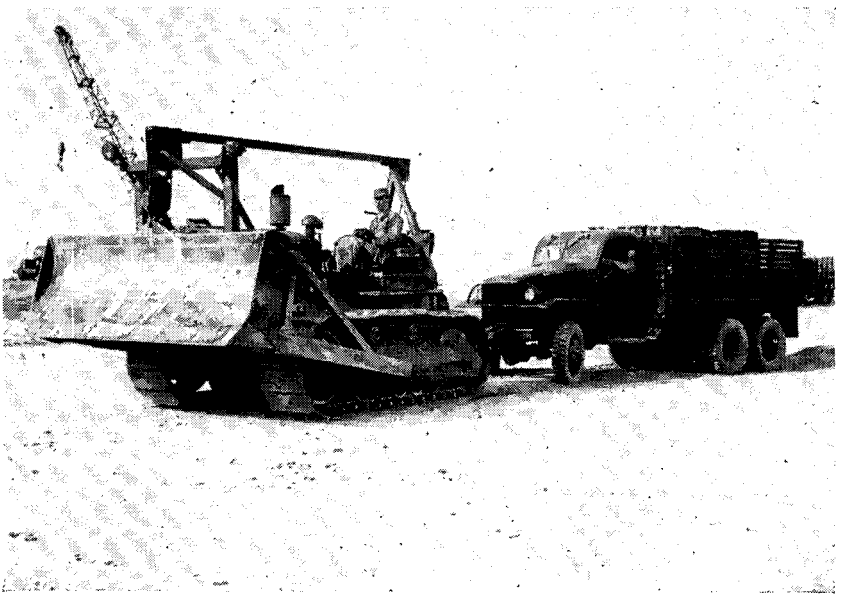


Figure 155. Use of a bulldozer to tow trucks out of soft sand.

CHAPTER 12

CARGO DAMAGE PREVENTION

206. GENERAL

Cargo damage is a result of rough, inexperienced, or careless handling during loading or discharge and the poor application of principles of proper stowage. The principal types of cargo damage and their preventive measures are discussed in paragraphs 207 through 214.

207. DAMAGE BEFORE SHIPMENT

a. Frequently, cargo is damaged in transit before it is received at the docks. This damage is beyond control of the stevedore; however, to detect it, a careful inspection must be made by the checker while the cargo is being received.

(1) It is often very difficult to detect damage. If there is any doubt about a certain package, notify the proper authority who will ascertain whether or not it is actually damaged.

(2) Watch for weak or leaking containers.

b. Packages which have insufficient packing for the contents and those which show signs of wear and tear or of attempted pilferage should be recoopered before loading. If this is impractical, they should be returned to the warehouse for redisposition.

(1) Their condition almost always worsens during the voyage. Such cargo not only arrives at the destination in a damaged condition but may damage other cargo stowed nearby.

(2) Never recooper security or bonded cargo without specific authority.

208. DAMAGE IN HANDLING

This damage is caused chiefly by weather conditions, breakage of cargo, and use of improper gear.

a. Because Army cargo must be loaded or discharged regardless of the weather, protection can be given cargo only when necessary steps are taken to cover the hatch openings and drafts while in motion.

(1) Hatch tents provided for such a purpose should be used. These tents also provide protection for the men working in the hatch.

(2) Tarpaulins used to cover the remaining cargo in the square of the hatch will do much to offset damage.

(3) Protection of the hatch and cargo will be wasted if the cargo is allowed to remain in the open on the pier after being discharged from the vessel.

b. The use of unsuitable or badly adjusted slings causes the dislocation or breakage of packages and the damage of their contents. Although in large ports stevedores will have slings suitable for cargo most frequently handled, some men will occasionally use the wrong type of sling because it happens to be handy. Trouble resulting from use of the wrong type of gear will occur more frequently in smaller ports where stevedore equipment may be limited, especially if some unusual shipment arrives.

(1) Avoid crushing light or fragile articles in slings and banging drafts of cargo against the hatch coaming. Very few commodities can be handled in net slings without crushing.

(2) To speed up loading or discharge, a sling may be filled with assorted boxes of different weights and strengths. If the lightweight boxes are not crushed or broken in the hoisting process, they may be when the sling is lowered in the hold.

(3) Sometimes a draft will be piled 10 feet or more in height; even though the fragile boxes are placed on top, this may not protect them, for when the sling is opened on the dock or hold some will fall and be broken and the contents damaged.

(4) Slings insecurely fastened around the load may part, or all of the load may be released and fall with a great force.

(5) Beware of careless winch work, especially when handling fragile cargo. Some winch operators are in the habit of landing a load in such a careless manner that the cargo in the sling, the sling itself, or the cargo already stowed may be damaged.

c. Use discretion when employing hooks, crowbars, and similar tools. Pay attention to the shipper's marks on the boxes—THIS SIDE UP, FRAGILE, etc.

209. DAMAGE FROM CHAFING

Chafing is usually the result of improper chocking of cargo within a vessel, railroad car, or barge. On a vessel, cargo damage will result if the vessel's motion causes the pieces of cargo to rub against each other and against projections in the hold. Chafing damage may also be caused by dragging some types of cargo over rough spots or other cargo. Chafing can have serious results in connection with inflammable cargo in metal containers, particularly if a spark is produced by static electricity. If cargo is properly chocked and dunnaged, there is very little possibility that chafing will occur.

210. DAMAGE FROM CRUSHING

Crushing of cases and containers is usually the result of carelessness in slinging, improper dunnaging, or pressure brought about by the stowage of heavy cargo on fragile cases.

a. Proper stowage, shoring, or chocking will almost eliminate damage to cargo from crushing.

b. The Army has made a special study of packaging which has resulted in the reinforcing and general improvement of packages. In a majority of cases, damage can be attributed to handling and stowing rather than to the construction of the containers.

211. DAMAGE FROM CONTAMINATION

In planning the loading of a ship, careful consideration must be given to the segregation of cargo to avoid damage through contamination and tainting.

a. Many foodstuffs can be contaminated by proximity to gasoline, rubber, etc.

b. Odors left in the hold of a vessel will taint some cargo. Therefore, the hold must be clean and free from odors before loading.

212. DAMAGE CAUSED BY WET CARGO OR MOISTURE

a. Damage caused by moisture is called sweat damage. It is the injury done to cargo by the condensed moisture which may corrode metals, mildew textiles, etc. This type of damage ruins more cargo than any other type. Sweat is basically caused by temperature changes during a voyage.

b. Damage caused by wet cargo is frequently the result of an improperly closed hatch which allows sea water to enter the hold. At times it may be necessary to land wet cargo. In this case, proper precaution for drainage should be made.

c. The methods employed to reduce or eliminate this type of cargo damage include—

(1) Proper processing of cargo before shipment.
(2) Proper use of dunnage to provide drainage and force circulation of air.
(3) Use of mechanical dehumidifying installation.

213. DAMAGE FROM SHIFTING

There is always danger that cargo may shift in any one of a number of directions if there is empty space not adequately shored off. Under the effects of violent rolling or hard pitching, a few pieces of cargo may give way, liberating others. These pieces, thrown against other cargo which in turn is dislocated, will bring serious damage to the

cargo as well as to the ship. The basic principles of cargo shifting are as follows:

a. If possible, leave no space into which cargo may shift.

b. If space is left, thoroughly secure and shore the cargo so that it cannot move.

c. If the cargo is likely to settle, make some provision to secure it after it has settled.

214. DAMAGE CAUSED BY PILFERAGE

a. This type of damage is extremely widespread and difficult to prevent. Proper stowage can prevent or diminish it.

b. The following precautions may be taken against pilfering during loading and discharging or while goods are on the pier:

(1) Use security lockers both on the pier and in the hold for pilferable cargo.

(2) Avoid working such cargo at night.

(3) Have a watchman or guard in the hold and on the pier at all times during the working of security or special cargo.

CHAPTER 13

PERSONAL SAFETY MEASURES

215. GENERAL

Safety is the responsibility of every individual in a port company. *Any accident which is preventable is avoidable.* Observance of the simple safety rules discussed in paragraphs 216 through 218 will prevent many accidents.

216. BOARDING AND LEAVING A SHIP

a. A gangway or ladder, properly secured, is the only safe way to board or leave a ship.

b. A rope ladder, commonly called Jacob's ladder, must be provided when working over the side to a barge or lighter. This ladder must be in good condition, sufficiently long, and properly made.

c. When using the ladder, grasp the *sides* and not the rungs or steps. If a step gives way, one is not so likely to fall if he is grasping the sides. Care should be taken that too many men are not on the gangway or ladder at one time.

d. Short cuts over the side to the pier or lighter by way of save-alls or skids, or by riding a draft or hook, are *strictly forbidden* except in emergency.

217. DECKS AND HATCHES

a. Decks should be kept reasonably clean and clear of gear and equipment that might fall or cause persons to trip and fall.

(1) Hatch covers should be piled neatly and securely so they cannot fall. Where practicable, and especially at lower hatch coamings and in the 'tween decks, the covers should be stacked at least 3 feet from the coaming.

(2) Wire, topping lifts, spare falls, beam bridles, hatch tarpaulins, and other gear should be placed neatly where they cannot be tripped over or damaged.

(3) Hauling parts of guy tackles or other rope should be coiled where they will not be damaged by cargo, gear, or hot steam pipes.

(4) Dunnage, if possible, should not be stowed on deck. When a small quantity must be on hand, it should be stowed in

slings so that it cannot be knocked over or will not interfere with a safe passage along the deck.

(5) Beams should be placed outboard against the rail or bulwarks. Hatch beams should lie on their sides or hard against the bulwarks with the last beam on its side hard against the other so that they cannot fall or be knocked over.

b. Beam bridle slings should have lanyards of sufficient length so that men may walk around the hatch to prevent the beam from swinging.

c. When working through a section of a hatch with beams in place, those beams in place should be properly pinned or secured.

d. When two compartments are being worked in the same hatch at the same time, a lifeline or safety mat should be rigged to prevent men from stepping or backing off into the open space.

e. Men should not be allowed to work or walk on hatch covers when the beam is not in place or when the hatch covers are damaged or do not fit; such conditions should be reported to a ship's officer so that replacements can be made as soon as possible.

f. Adequate lighting should be provided both in the hold and on deck at all times. Entering ship's holds or other dark compartments without sufficient natural or electric light is prohibited. Using matches or open lights in such places is strictly forbidden.

218. HANDLING LINES ON SHIPS, LIGHTERS, AND SMALL CRAFT

a. When handling ship's lines on piers having a narrow string piece, doors should be open. Mooring cleats should be clear of dunnage, cargo, and any material which may interfere with the proper handling of lines.

b. Men should stand well away from a line under strain and face in the direction of the strain.

c. Men should heave on a line so that the lead or pull is in the direction to do the most good. When heaving a lighter along a high ship, lead the lines to the offshore side of the lighter to obtain the best mechanical advantage. If lines are on the inshore side, more power is used in trying to lift the lighter from the water than in pulling it alongside.

CHAPTER 14

FIRE PREVENTION AND FIRE FIGHTING

Section I. FIRE PREVENTION

219. GENERAL

a. In 1942, one of the largest and fastest vessels in the world was undergoing repairs in New York harbor. Fire broke out on board, and before it was extinguished, the vessel was completely gutted and on its side at the pier. No cargo or troops were lost in the fire, but the pier and a vessel which could carry a division were lost at a time when both vessels and pier facilities were at a premium.

b. Fire aboard ship is a catastrophe which, unchecked, not only endangers the lives of persons aboard the vessel but may destroy cargo and the ship itself. Fire fighting is a responsibility of the master of the vessel, and he may call upon members of a port company working the ship to assist in quelling the blaze.

c. There are three essential factors in good fire prevention—

(1) Strict fire prevention discipline.
(2) Readiness of fire fighting equipment.
(3) Understanding of fire fighting technique.

220. CAUSES OF SHIPBOARD FIRES

Fire aboard a vessel may be caused by bombing, spontaneous combustion in the cargo, explosion, smoking, carelessness, or some other occurrence. The general cause of shipboard fires is carelessness on the part of the men who load or dicharge the ship.

221. PREVENTIVE MEASURES

Fire prevention requires the elimination of conditions that cause fires or provide the materials upon which fires feed. Stevedores working a ship should be familiar with the causes of shipboard fires and, with that knowledge, be able to take preventive measures. Some of these measures of prevention are as follows:

a. Smoke only in authorized areas on board a vessel or on a pier.

b. When driving, particularly gasoline-driven equipment, do not park equipment adjacent to cargo that could be set afire by the exhaust.

c. When removing deep tank covers, lift them clear; do not drag them when contact with other material could produce a spark caused by static electricity.

Section II. FIRE FIGHTING

222. GENERAL

a. If a fire starting in the hold of a vessel should block the escape ladder, the only way hold men can be released is by hoisting. A cargo net secured to the end of cargo falls is the quickest method of hoisting the men. If pallets or platforms are used, precaution should be taken to secure the bridle to the pallet.

b. When the men have been taken out of the hold, the winches should be secured in a neutral position and the power turned off. Available men aboard the vessel not engaged in securing the ship's gear should render all possible assistance to those fighting the fire.

223. TYPES OF FIRES

a. Class A, class B, and class C fires are the three general classes.

(1) Class A fires occur in ordinary combustible materials such as bedding, clothing, wood, canvas, rope, and paper; the cooling effect of water is of first importance. The embers or ashes remaining after the burning are the chief characteristic of a class A fire, which must be entirely cooled before extinguishment is complete.

(2) Class B includes those fires in inflammable liquids such as gasoline, oils, grease, paint, and turpentine, where smothering or blanketing is essential.

(3) Class C fires are those occurring in electrical equipment where the use of a nonconducting extinguishing agent is of first importance. Carbon dioxide is a nonconductor of electricity and will not damage electrical equipment.

b. Fire involving ammunition is extinguished with water.

224. EXTINGUISHERS AND THEIR APPLICATION

There is a specific extinguisher for each type of fire. Some of the types found in general use are discussed in *a*, *b*, and *c* below.

a. Flooding Systems.

(1) The flooding systems found aboard vessels are usually of two main types—the steam smothering system in which boiler steam is released to smother the blaze, and the carbon dioxide smothering system.

(2) Smothering systems are principally advantageous for fires located in an area that can be converted into an airtight compartment. A disadvantage is that the blaze cannot be fought by another method at the same time.

(3) Water may also be used to flood a compartment where a fire is burning. However, this type of flooding necessitates

removal of the water after the fire is out, and there is danger of the vessel's listing or capsizing.

b. Hand Extinguishers. Hand extinguishers used on vessels are of five main types.

(1) *Carbon dioxide.* A carbon dioxide extinguisher is excellent for small compartments. This type may also be used effectively on machinery fires or electrical motor fires. Carbon dioxide is a nonconductor of electricity and leaves no residue to be removed after the fire is out. Carbon dioxide extinguishes a fire by displacing the oxygen, thereby smothering the blaze. For this reason, a man operating an extinguisher cannot stay in the area for a long period of time. The "fog" given off by the extinguisher, if not removed, will blister the skin and cause painful burns. The 15-pound unit is the standard hand extinguisher found aboard ships. The correct method of using the extinguisher is to grasp the handle in one hand and turn the valve with the other.

(2) *Foam or foamite.* The foam or foamite extinguisher is used for a deep-seated fire, covering the blaze with a heavy blanket of foam which allows no air to reach the fire. The principal disadvantage is that the foam must be cleaned up after the blaze is extinguished. This extinguisher is particularly effective against oil fires. It is operated by holding it upside down in one hand and directing the foam with the other.

(3) *Soda and acid.* Sulfuric acid is automatically released into the mixture of soda and water when the extinguisher is inverted. The action of the acid on soda creates the necessary pressure to play the stream on the fire. This extinguisher is easily refilled and is very good for a small deep-seated fire. It is operated in the same manner as the foamite extinguisher. Caution should be exercised when using this extinguisher, as the acid may damage clothing or burn the user.

(4) *Carbon terachloride.* This extinguisher is small and convenient to handle. It is operated in the same manner as the bicycle pump and can be filled easily. When this type of extinguisher is played on a very hot fire, the carbon tetrachloride gives off poisonous gases creating a danger for anyone in the immediate vicinity.

(5) *Water pump.* This type of extinguisher is merely a small drum filled with water with a hand pump attached. The pressure is created by the pumping action supplied by the operator.

c. Fundamental Rules. Effective fire fighting is the application of a general knowledge of fire fighting to the particular problem which

confronts the personnel at the time of action. The following fundamental rules should always be borne in mind:

(1) The fire should always be attacked, as soon as possible, with the extinguishing agent indicated by the type of burning material.

(2) Bulkheads and decks of adjacent compartments should be kept cool and the fire prevented from spreading. Fires in confined spaces may be brought into control by excluding air, thereby cutting off the oxygen supply system.

(3) Class A fires leave embers which are subject to reignition. This is especially true of fire brought under control with carbon dioxide or steam. Material of this type must be cooled throughout with water before extinguishment is complete.

(4) Foam is the best material to use in extinguishing large or gasoline fires.

(5) In a smoke-filled compartment, the best air for breathing will be found close to the deck.

(6) All fires can be extinguished by trained personnel using proper equipment.

CHAPTER 15

MAINTENANCE OF CARGO AND EQUIPMENT

225. SERVICE SECTIONS

a. The duties of a service section are to maintain and repair equipment used by a port company and to make any gear needed during the loading and discharge operation. Members of this section include mechanics, crane operators, blacksmiths, carpenters, welders, and riggers.

b. Headquarters and service company of the port battalion is provided with a battalion stevedore gear and equipment section equipped to perform the necessary service duties for attached port companies. The basic organization of a port company as provided in T/O&E 55–117 allows for a service section upon request of the theater commander. Organically a type B port company is provided with a service section capable of limited repairs and maintenance of gear.

226. MAINTENANCE REQUIREMENTS

Requirements for maintenance in cargo operations fall into three general classes—

a. Cargo. Maintenance of cargo consists of repairing broken cargo containers to make them fit for further shipment. At times, new containers will have to be built.

b. Gear. Cargo handling gear must be lubricated, checked for defects, and repaired as needed in order to maintain safety factors and insure continuous operation.

c. Materials Handling Equipment. Continuous maintenance on fork lifts, cranes, tractors, and trailers is essential to prevent breakdowns which severely retard the loading and discharge of cargo.

227. MAINTENANCE OPERATIONS

Maintenance of tools and equipment is necessary for successful operation.

a. Carpentering.

(1) The carpenter and cooper in a port battalion, section, or company must be a skilled man capable of handling any job involving the use of wood. He should know many types of construction and building as well as how to make emergency repairs. He must be able to perform the jobs connected with

stowage, such as the bracing, shoring, and tomming of cargo and the building of catwalks and bulkheads. Other jobs will involve the building and repair of crates and boxes damaged during cargo handling.

(2) TM 5–226 offers a complete and thorough coverage of the selection of lumber and the care and maintenance of hand tools. It offers detailed information and instruction regarding rough carpentry used in theaters of operation.

b. Blacksmithing.

(1) The duty of the blacksmith in the port battalions and companies is to make and repair metal equipment used in cargo handling operations. The blacksmith is a specialized repairman capable of forging small tools and maintaining metal gear in operating condition. His work often merges with that of the rigger in building various types of gear and with the welder in keeping metal parts in a safe working condition.

(2) For this specialized duty, the blacksmith must have a thorough knowledge of the use of the forge and anvil as well as the other tools of his trade. See TM 5–225 for further information.

c. Welding. A port company welder must know how to operate all types of welding equipment, as he must be able to do any welding job necessary to maintain cargo handling equipment. For complete information on this subject see TM 9–2852.

d. Materials Handling Equipment Repair.

(1) *Cranes.* In the operation of cranes, as well as any other mobile equipment, proper maintenance and lubrication are essential. Because of the heavy shock loads and rapid reversal of stresses encountered by a crane in active service, extremely careful and complete maintenance must be the rule. Safety as well as performance dictates thorough maintenance of these machines. Routine adjustments of brakes and clutches, proper lubrication, maintenance of correct tension of crawler treads, chains, and belts, and similar tasks are the responsibility of the crane operator.

(*a*) A grabbing clutch indicates the presence of grease or oil. A slipping clutch shows that it is too loose.

(*b*) Lubrication should be accomplished on a routine basis. The lubricating interval should be multiples of 8 hours, or one working day shift.

(*c*) Caterpillar cranes commonly employed by the Army require proper adjustment of the crawler treads and the chain drive which motivates these treads. Treads which are too tight place a strain on the couplings and make operation in mud or loose dirt difficult if not impossible. Treads should

be kept as loose as possible without losing proper tracking of the driving tumblers.

(*d*) For proper engine operation, the operator must observe the following 10 rules:

1. Know the engine.

2. Read and follow the advice contained in the manual of instruction and in the appropriate technical manual.

3. Keep the engine and its accessories clean. Keep the radiator filled with clean water. Never add water to an overheated engine.

4. Use only the oil of recommended specification.

5. In starting, use the choke no more than necessary.

6. Warm up the engine slowly, especially when the weather is cold. Never race a cold engine.

7. Do not force the engine; avoid overload. When not using the engine, idle it; stop it if the period is prolonged, unless the weather is subzero—then allow the engine to idle.

8. If trouble develops, correct it before it becomes serious.

9. Always keep the air and oil filtering systems clean.

10. Visually inspect the engine and its accessories daily.

(2) *Tractors and trailers.* Preventive maintenance is divided into two parts—daily and scheduled. Daily maintenance consists of checking air, water, oil, gas, and general cleanliness of the vehicle. Scheduled maintenance calls for such tasks as changing oil, replacing filters, washing air cleaners, and checking battery, water, and lubrication. Frequent lubrication with proper lubricants is essential.

(3) *Fork lifts.* Inspection of fork lift trucks must be regular and periodic. The main objective of an inspection is to anticipate repairs before a breakdown occurs. The operator who inspects a machine should note any defects so that a mechanic may repair them immediately. Driver inspections should include checking of lights, horn, tire pressure, oil, gasoline, hydraulic fluid level, and grease assemblies. Large fork lift trucks may have chain drive lifts in place of hydraulic lifts and cylinders. All parts of the machine do not require lubrication at the same time. Those parts in operation more than others or which are subjected to heavy strain must be serviced more frequently. See the appropriate technical manuals for further information.

APPENDIX

REFERENCES

1. FIELD MANUALS

FM 21–8 Military Training Aids
FM 55–25 Ports in Theaters of Operations
FM 55–150 Amphibian Truck Company
FM 60–30 Amphibious Operations Embarkation and Ship Loading (Unit Loading Officer)

2. TECHNICAL MANUALS

TM 5–225 Rigging and Engineer Hand Tools
TM 5–226 Carpentry
TM 5–1197 Shovel, Power, Crawler Mounted, Gasoline ¾ cu. yd. (Model No. 70 with Buda Engine Model K–393)
TM 9–2852 Instruction Guide, Welding Theory and Application
TM 55–335 Operation of Floating Cranes

3. TABLES OF ORGANIZATION AND EQUIPMENT

T/O & E 55–115 Transportation Port Battalion
T/O & E 55–116 Headquarters, Headquarters and Service Company, Transportation Port Battalion
T/O & E 55–117 Transportation Port Company (Type A)
T/O & E 55–118 Transportation Port Company (Type B)

4. ARMY REGULATIONS

AR 55–470 Transportation by Water of Explosives, Inflammables, and other Chemical Materials
AR 55–485 Transportation of Animals on Transports

5. SPECIAL REGULATIONS

SR 110–1–1 Index of Army Motion Pictures and Film Strips
SR 310–20–3 Index of Army Training Publications
SR 310–20–4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins,

Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.

SR 310–20–5 Index of Administrative Publications
SR 310–20–6 Index of Blank Forms
SR 320–5–1 Dictionary of U. S. Army Terms
SR 320–50–1 List of Authorized Abbreviations
SR 55–730–10 Transportation and Travel, Passenger Accommodations aboard U. S. Transports.

6. MISCELLANEOUS

"Regulations Governing Transportation of Military Explosives on Board Vessels During Present Emergency," NAVCG 108, revised 6 September 1945, U. S. Coast Guard publication
"Modern Ship Stowage," U. S. Department of Commerce

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